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Developing a Comprehensive Service Strategy to Meet a Range of Suburban Travel Needs

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EXECUTIVE SUMMARY

This study was designed:

1) To identify promising non-traditional transit options which had been developed for highly suburban areas,

2) To develop a methodology allowing transit operators a) to identify which non-traditional services might be appropriate for which areas given local demographic, land-use, and geographic factors, and b) to evaluate the cost-effectiveness of promising methods of non-traditional options, and,

3) To illustrate the use of the methodology on a case site--a sixty square mile low density area in the service area of the Capital Area Metropolitan Transportation Authority of Austin, Texas.

The study had four parts. The first part found that jobs and residential growth have overwhelming occurred in the **suburbs** producing travel needs not well met by traditional transit: suburb-to suburb commutes, non-traditional peak trips, and reverse flow travel. Moreover, the suburbs are increasingly the home of non-choice riders: the poor, the elderly, the single parent, and the handicapped. These groups, too, are part, of the suburban transportation problem.

The second part of the Study identified promising non-traditional transit options which could meet the variety of work and non-work needs which have emerged in suburban areas. The study particularly focused on how well ideas about successful and/or highly publicized transit alternatives had been disseminated to, and adopted by, transit operators across the country. The findings showed that, although there were a number of promising non-traditional alternatives available--many actually pioneered by small or mid-sized cities--they were not widely practiced by the transit industry. Only two of the 22 mid-sized cities surveyed--Austin and Greensboro--were implementing any of the promising techniques.

The third part of the Study developed a six-step planning methodology designed to identify groupings of work and non-work trip attractors in low density and suburban areas, to match those needs to promising suburban service options, and to evaluate the costs of various ways of delivering those options, including the active involvement of the private sector.

The fourth and last part of the study was designed to apply the six-step methodology to the service issues facing a local transit operator, the Capital Area Metropolitan Transit Authority of Austin, Texas. The methodology was used to help Capital Metro expand the use of non-traditional transit services by 1) identifying which non-traditional options might be appropriate for different locations in Austin, 2) considering how appropriate non-traditional transportation options might be more widely implemented in the service area, and 3) investigating ways to incorporate planning for such options into the on-going Service Planning efforts.

Overall, using the methodology, the Study Team found that 1) **vanpooling** for major employment concentrations and **demand-responsive services** in limited areas for non-work trips would be appropriate for the suburban development found in the sixty square mile Highway 183 Corridor, 2) appropriate non-traditional options would or do incur costs lower than Capital Metro's average cost/hour for fixed route bus service, and 3) several non-traditional alternatives could be implemented in the 183 Corridor with total subsidies at or below those required by conventional transit services.

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INTRODUCTION

BACKGROUND

Traditional transit services do not offer meaningful mobility to the majority of suburban residents. The suburb to suburb commute pattern created by the dispersion of homes and jobs, coupled with traditional transit's lack of competitiveness in suburban areas, has created a major drop in transit ridership across the country and particularly among suburban workers: only 1.6% of suburban workers used transit to go to work in 1980 and that percentage has been falling in the intervening decade.

Moreover work-trips are not the only suburban transportation issue. The same demographic changes that created the suburban commuter crisis has also given us suburbs full of traditional non-choice riders: the young, the old, the handicapped, the second worker in a one-car household. Transit operators must find ways to respond to the whole range of issues that constitute the "suburban mobility problem."

Clearly transit operators must develop new and non-traditional ways of delivering transit services in suburban areas. These non-traditional alternatives must respond to a range of suburban issues: the need for flexibility, the lack of concentrated corridors (or even clearly established peak periods),the widespread dispersals of homes and jobs, and the variety of citizens who require services.

STUDY APPROACH

This study was designed:

1) To identify promising non-traditional transit options which had been developed for highly suburban areas,

2) To develop a methodology allowing transit operators a) to identify which non-traditional services might be appropriate for which areas given local demographic, land-use, and geographic factors, and b) to evaluate the cost-effectiveness of promising methods of non-traditional options, and,

3) To illustrate the use of the methodology on a case site--a sixty square mile low density area in the service area of the Capital Area Metropolitan Transit Authority of Austin, Texas.

To begin, the Study Team identified successful non-traditional options and undertook a comprehensive survey of 22 mid-sized American cities to determine a) how extensively non-traditional services had been adopted by cities of this size across the country, and b) if additional options or combinations of options had been developed locally which had not been widely discussed.

Next, the study developed a six step method to allow local operators to develop a comprehensive and cost effective service strategy for suburban transit development, given the difficult suburban environment and the existence of viable service options. The methodology **first** gives operators a way to match potential transit and paratransit options to the range of travel needs identified in suburban areas, and **second**, allows operators to consider the cost effectiveness of various ways of delivering those service options, including the active involvement of the private sector.

Finally the Study Team applied the methodology to the service issues facing a local transit operator, the Capital Area Metropolitan Transit Authority of Austin Texas. The methodology was used to help Capital Metro expand the use of non-traditional transit services by 1) identifying which non-traditional options might be appropriate for different locations in Austin, 2) considering how appropriate non-traditional transportation options might be more widely implemented in the service area, and 3) investigating ways to incorporate planning for such options into the on-going Service Planning efforts. (Detailed information about the methodology in use, and the data on which it relied, are given in the Appendix.)

The methodology demonstrated that 1) **vanpooling** for major employment concentrations and **demand-responsive services** in limited areas for non-work trips would be appropriate for the suburban development found in the study area, 2) appropriate non-traditional options would or do incur costs lower than Capital Metro's average cost/hour for fixed route bus service, and 3) several promising non-traditional alternatives could be implemented in the study area with total subsidies at or below those required by conventional transit services.

REPORT ORGANIZATION

The section that follows is the first substantive part of the report; it describes the "new" suburban environment in which public transit operators must provide services, showing how the increasing suburbanization of jobs has created both work and non-work trip patterns not easily served by traditional transit. The second substantive section of this report describes both "prototypes" of non-traditional services that have been used across the United States, and, the results of the survey of 22 mid-sized (200,000-700,000) cities.

The third section of the report describes the six-step service and cost-effectiveness methodology, explains the logic of the process and the data and sources of data required. The fourth section of the report describes how this six-step methodology was applied in Austin, Texas.

THE SUBURBAN TRANSIT ENVIRONMENT

INTRODUCTION

Suburban residents face a number of transportation problems--problems which traditional fixed route transit services, with their traditional focus on the historical center of the city, do little to address. A number of trends have interacted to produce both the suburban transportation environment and the challenges facing public transit operators--this section will focus on them.

Initially there were a series of major demographic trends: first, the majority of population growth in the last three decades went to suburban areas, making the U.S. a suburban, not really an urban, nation. Second, the majority of new jobs in the last thirty years also went to suburban areas across the country. Third, the overwhelming number of suburban families have cars--as a response to the lack of transit or the need for flexible transportation, or increasing affluence, or the growth of two-worker families--or all of these reasons.

These demographic trends changed a number of variables within the suburban environment itself in ways that today make traditional transit unattractive or infeasible. First, the majority of home-to-work trips are taken from one suburb to another, not the kind of service transit has traditionally provided. These impact of these non-radial travel patterns is heightened by the nature of suburban jobs, particularly those in the service sector, whose locations lack the concentrated corridors of demand needed to effectively provide transit services.

Second, suburban jobs increasingly create non-traditional commuter traffic--off-peak and week-end travel, for example. Third, car owners are five times more likely to drive than to use transit; not surprisingly transit use is lowest among suburbanites[1].

But work-trips are not the only suburban transportation problem. The same demographic changes that created the suburban commuter crisis has also given us suburbs full of traditional non-choice riders: the young, the old, the handicapped, the second worker in a one-car household. By the first decades of the next century the majority of all these "captive riders" will live in the suburbs of all but a few metropolitan areas![2] Any transit solution to the "suburban mobility problem" must respond to the needs of non-workers as well as the new suburban commuter.

The sub-sections below describe these trends in detail in an effort to understand how the transportation needs of suburban residents could best be met, without relying solely on the personal car driven alone.

POPULATION TRENDS

The dimensions of suburban population growth are staggering. In 1950 a little over half of all Americans lived in metropolitan areas; by 1984 almost two-thirds of the population lived in metropolitan areas. But the central cities of those metropolitan areas had a disproportionately small share of that growth; while U.S. population rose 56.1% in the forty years since WWII and metropolitan areas grew 76.1%, central cities only grew 49.9%. In contrast the suburban population grew almost 200% in the same years!

In 1950 23% of the American people lived in the suburbs; by 1984 over 44% of the entire population lived in suburbs while central cities continued to be the home of roughly one-third of all Americans.[3] This tremendous increase in suburban population was a result of two factors: rural areas lost significant population numbers--largely to suburban areas--and 86% of total US population growth since 1970 went to suburban areas.

Other important demographic trends have relevance for transit planners: suburban areas, particularly in the South and West, have increasingly become the home of the elderly, ethnic minorities, and new immigrants to the United States. In 1970 more elderly lived in Central Cities than lived in the suburbs[4] but as Table One shows, between 1970 and 1980 a shift in the elderly population took place as the suburbs of metropolitan areas became the home of the majority of those over 65. Given the increasing tendency for the elderly to age in place, it is likely that suburban areas will have a large and growing number of elderly citizens who will initially or eventually be unable to drive.[5] John Kasarda noted, in a recent report prepared for the National Research Council, that "since most of the aged population in the year 2020 will reside in the suburbs and smaller towns, issues of future transportation availability and accessibility must be addressed."[6]

Kasarda, a noted sociologist and demographer, has also found that while **ethnic and racial minorities** were increasing absolutely and relatively in both central cities and suburbs, their growth was fastest in the suburbs. Moreover in the South and West (the site of most projected U.S. population growth), he found that minorities were far more likely to settle in suburban areas, composing from 18 to 25% of suburban populations.[7]

In addition Kasarda found that most of the massive **migration** to the United States over the last three decades has gone to the South and West, with Houston, Los Angeles, and Miami replacing New York as a "port-of-entry." Within these areas the overwhelming number of immigrants have settled in suburban and nonmetropolitan areas. In short the greatest number of all migrants to the U.S. since 1970 have become suburban residents. While not all are poor, or lack transportation, clearly a disproportionate share will be non-choice riders initially.

All of the trends enforcing suburban population dominance are expected to continue. As Kasarda suggests,

> Most...future metropolitan population growth...will no doubt be in the suburban rings both because of the economic advantages they hold for business and industry and because preference surveys consistently document that the suburbs are, by a wide margin, the modal residential choice of the American population.[8]

EMPLOYMENT AND COMMUTING TRENDS

Allied to the explosion in suburban population has been the explosion in suburban jobs; these two trends taken together have created new, non-traditional, commuting patterns to which transit operators must respond. Several recent studies clearly show that the "traditional commuter," traveling for work from the suburbs to the historic core of the city, represents a rapidly declining number of all workers [9]. In fact, one researcher has suggested that the so-called traditional commute pattern may only have been a transitional stage in American development patterns.[10]

Between 1960 and 1980 83% of all metropolitan job growth went to the suburbs--which now have over 60% of all U.S. jobs. These patterns are uniform; even in slow-growth parts of the country with declining population (for example, Philadelphia, St. Louis, Pittsburgh, and Buffalo) suburban employment growth far outstripped total employment

Table 1

Percentage Distribution of the Elderly within SMSA's by Region of The Country,1980

	TOTAL	SMSA CENTRAL CITY	SMSA SUBURB	RURAL
WEST				
60-64	81.3	41.2	58.8	18.7
65-69	80.6	42.4	57.6	19.4
70-74	80.7	43.9	56.1	19.3
75-79	81.7	45.5	54.5	18.3
80-84	82.8	47.3	52.7	17.2
85+	82.6	47.9	52.1	17.4
SOUTH				
60-64	63.8	43.1	56.9	36.2
65-69	62.0	43.3	56.7	38.0
70-74	61.9	44.1	44.1	38.1
75-79	62.3	46.0	54.0	37.7
80-84	62.6	47.5	52.5	37.4
85+	61.5	49.1	50.9	38.5
NORTH CENTRAL				
60-64	68.0	41.5	58.5	32.0
65-69	65.5	44.0	56.0	34.5
70-74	63.9	45.7	54.3	36.1
75-79	63.3	47.1	52.9	36.7
80-84	62.2	47.1	52.9	37.8
85+	60.1	46.8	53.2	39.3
NORTHEAST				
60-64	85.1	39.2	60.8	14.9
65-69	84.1	41.7	58.3	15.9
70-74	83.5	43.2	56.8	16.5
75-79	83.9	44.6	55.4	16.1
80-84	84.2	44.1	55.9	15.8
85+	83.7	42.4	57.6	16.3

Key: SMSA's = Central City + Suburb.
Source: U.S. Department of Commerce. Bureau of the Census. Census of Population: 1980. General Social and Economic Characteristics. PC(1) C1. United States Summary. table 193.

growth--these areas experienced suburban job growth even when total job growth was negative![11]

Of course many central cities did experience absolute job growth and remain viable work places. But central city employment growth was overwhelmed by employment growth in the suburban rings. As a result of the tremendous increase in suburban population and jobs, the majority of work-trip growth, roughly 70%, was in the suburb-to-suburb trip pattern.

Table Two shows that, in the two decades from 1960 to 1980, central cities received roughly a third of all increases in the number of metropolitan work trips while suburban areas gained roughly two thirds. Moreover, 83% of all new work trips were originating in suburban areas. The so-called reverse commute, from central city to suburb, grew as much as did the central city to central city commute-8.5%.

Table Three shows how the relative changes shown in Table Two are reflected in the absolute distribution of trips in 1980. A little over one half of all work trips within metropolitan areas were made to central city destinations; a little under one-half to suburban destinations. But the single largest work trip flow was from one suburb to another, accounting for over one-third of all trips, while less than 20% of all trips were made in what was once a traditional pattern--suburb to central city. The number of **reverse trip** commutes became significant as did the number of trips to suburban areas from outside the metropolitan area. All three of these trip patterns are relatively difficult for traditional transit to serve well.

Even these numbers, however, may understate the importance of low density travel because the Bureau of the Census definition of "central city" coincides with the **legal boundaries** of a city, and is not limited to the traditional core or CBD of that city. In many cities, particularly those in the South and the West, this definition would include low density residential areas 20 to 40 miles away from the traditional city core, areas that commonly would be considered "suburban."

Table Four addresses this definitional problem. The Table shows that an overwhelming percentage of work trips destined for the central city are, in fact, destined for areas outside the traditional core. Five times the number of work trips originating in both the suburbs and the central cities of metropolitan areas were destined for outside the central city. Fewer than one trip in seven considered to have a central city destination was actually intended for the CBD.

In short, a large number of current work trips are not made in traditional urban areas, are not destined for centralized destinations, and are not along well-defined heavily travelled corridors. Thus, as a major report on commuting patterns recently commented,

> The negative effects on transit of current [suburban employment] trends are clear. Growth is centered where transit use is weakest--in the suburb-to-suburb market, and high levels of [private] vehicle availability severely diminishes the choice of transit [12]

COMPETITION BY THE PRIVATE CAR

To the increasing suburbanization of the population and of employment, must be added the growing American ownership of private cars. Most American families own one car and many own two[13]. Although low income families are less likely to own cars, and more likely to use transit, over 60% of American families making under $10,000 in 1980 owned one car and 20% owned two cars![14] Moreover car ownership rates are not uniform; the majority of households without cars are in the central city. In short, most suburbanites

Table 2

Percentage *Increases* in Suburban and other Commuting Flows, 1960-80

Workers Living in	Central City	**Traveling to** Suburbs	Total
Central City	8.5%	8.5%	17%
Suburbs	25%	58%	83%
Total	34%	66%	100%

Source: Derived from Table 3-4, Eno Foundation, Commuting in America

Table 3

Percentage of Workers Commuting to Central City and Suburban Jobs by Residence

Workers Live In	Workers Employed in: Central City N (000,000)	Central City % of all trips*	Suburbs N	Suburbs % of all trips*	Total N	Total % of all trips*
Central City	20.9	30.4	4.2	6.1	25.0	36.5
Suburbs	12.7	18.5	25.3	36.8	38.0	55.3
Outside SMSA	2.7	3.8	3.1	4.5	5.7	8.3
Total	36.2	52.7	32.6	47.3	68.8	100.0

Source: Derived from Tables 3-7 and 3-9, Eno Foundation, Commuting in America, p 44-45.

* % of all trips with central city or suburban destination; excludes trips with rural or other metro area destinations; or approximately 4.8 million trips.

Table 4

Actual Destination of Central City Workers, 1980

	Travelling To			
	CBD		Remainder of Central City	
Workers Living in	N (000,000)	% of total trips*	N (000,000)	% of total trips*
Central City	3.1	9.3	17.7	52.8
Suburbs	2.2	6.6	10.5	31.3
Total	5.3	15.8	28.2	84.2

Source: Derived from Table 3-8, Eno Foundation, Commuting in America, p.44.

* Percentage of total trips with central city destinations and suburban or central city residences; does not include rural or other metropolitan commuters into central cities.

have cars.

Car ownership, by itself, can have a devastating impact on transit use. Table Five shows that in 1980 in all U.S. households where each worker had access to a car, transit use was low, and had fallen from 1970. Even in households where each worker did not have access to a car, only one in five workers used public transit to go to work, and this percentage had also dropped considerably since 1970.

In suburban areas the auto offers even greater competition to traditional transit services, in part because speed differentials between the two modes are greater in suburban areas. Data from the American Housing Survey show that, on average buses, streetcars, and subways in the US average 13.2 miles per hour, less than half as fast as either cars or carpools [15] Since the average suburb-to-suburb commute in 1980 was 8.2 miles, a direct transit trip--with no waiting or transferring--would take approximately 37 minutes by bus but only 16 minutes by car; a transfer or a lengthy walk at either end of the trip could increase the transit time to nearly an hour!

Non-work trips are also not well served by traditional fixed route services. Data from the 1983 National Personal Transportation Study show that a striking percentage of all trips which people currently make in a car (as a driver or passenger) simply could not be made by transit in a reasonable time period (or at all by walking). Figure I shows the average trip length by trip purpose of all trips taken in metropolitan areas in 1983 and suggests how far travellers could go using ideal, ubiquitous transit (coming within 2 blocks of both origin and destination and requiring no transfer). In general, suburban trips are longer than metropolitan trips and few could be taken using ubiquitous transit in under one half-hour--although all could be easily served by a car in far less time. The average social and recreational trip could not even be accommodated by ideal transit in under an hour although easily taken in a car in less than half that time.

Obviously, most suburbanites do not have access to anything like ubiquitous transit service. Cervero has noted the implications of the lack of convenient transit services,

> Even workers in suburban office towers located around rail transit stations are almost entirely dependent on the automobile. Regardless of how conveniently rail transit serves suburban office centers, if only a fraction of the workforce lives near a line, most employees will end up driving [16]

Moreover, the suburban transit service that does exist has relatively long head-ways (ie buses coming only every 30-60 minutes), is not accessible to a variety of handicapped people (because the front step is so high, current buses pose problems to many elderly and handicapped people, not just those using wheelchairs), and may not be perceived as safe by the elderly or for young children. In short, transit is not competitive in many ways with the private car in suburban areas.

Even the way suburban employment concentrations have developed favors the private car. Most major employment complexes lack housing, daycare centers, retail establishments, banks, and restaurants; workers must leave the site to carry out domestic responsibilities (and even to eat lunch). If workers wished to use transit, they would be deterred by the lack of mid-day mobility and the need to carry out errands--away from the job site--before and after work.[17] [18] Moreover, as Robert Cevero has noted, these employment complexes often offer abundant free parking (hardly an incentive to transit use) and they are physically designed in ways that make walking and transit use inconvenient.

Table 5

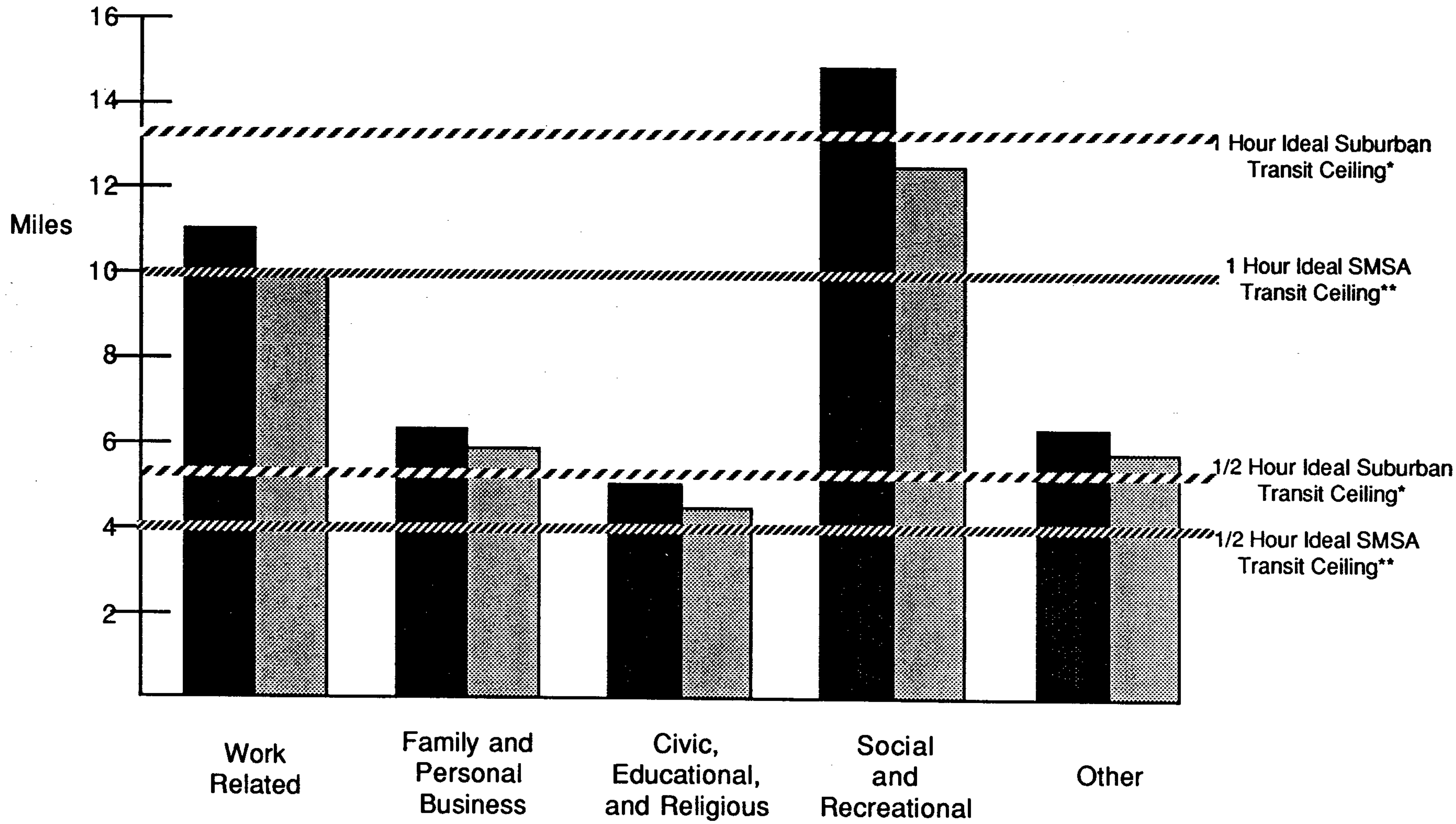
Auto Availability and Transit Use, 1970 - 1980

	Workers (000,000)	Number Using Public Transit (000,000)	% Using Public Transit
Workers in Households with less than 1 auto per worker			
1970	17.04	4.81	28.2
1980	19.13	3.94	20.6
Workers in Households with at least 1 auto per worker			
1970	26.89	1.40	5.2
1980	39.07	1.76	4.5

Source: Table 3.14, Eno Foundation, Commuting in America, 1988, p. 51.

Figure I

Average Trip Lengths for Suburban Trips and Entire-SMSA Trips



* *Assuming 10 minute walking time and 16 mph transit speed*

** *Assuming 10 minute walking time and 12 mph transit speed*

> Many suburban workplaces, for all intents and purposes, are pre-ordained for automobile usage. Particularly in the case of campus-style office parks, where liberally spaced, low-lying buildings dominate the landscape, the private auto faces no serious competition. [19]

IMPLICATIONS FOR TRADITIONAL TRANSIT

Given the suburb to suburb commute pattern created by the suburbanization of homes and jobs, coupled with traditional transit's lack of competitiveness in suburban areas, it is not surprising that transit use has dropped across the country and particularly among suburban workers. Nationally transit ridership has dropped 10% for each of the decades since 1950. As Table Six shows the smallest transit ridership within metropolitan areas in 1980 was recorded for suburb-to-suburb commutes; only 1.6% of these workers used transit to go to work (compared to 16.1% of workers who both lived and worked in the central city).

Even suburban employment concentrations show little use of transit. Robert Cervero's nationwide study of 120 suburban employment complexes found that in all but 4 complexes fewer than 10% of all workers used any form of transit or ridesharing, even when there were transit amenities or preferential carpool/vanpool parking. [20]

John Kasarda's commentary on the suburban transit environment seems a logical conclusion to draw from analyzing suburban trends,

> Traditional public transportation will likely be eschewed by those working in the periphery because of its spatial and temporal inflexibility and the related fact that most suburbanites desire to be in control of their movements, even at additional cost. [21]

And as Robert Cervero has noted,

> The suburbs represent, by and large, a new and challenging milieu for transportation planning. Because transit services there are sparse and jurisdictions tend to be fragmented, solutions are apt to be more difficult to come by in suburban than in central cities.[22]

Clearly transit operators must develop new and non-traditional ways of delivering transit services in suburban areas. These non-traditional alternatives must focus on overlapping employment and non-employment travel in suburban areas because a) it is difficult to promote transit or ridesharing without sufficient mid-day transportation options for those leaving their cars at home, and b) suburbanites without any or consistent auto availability also have important travel needs.

In response to these service problems, some transit properties have begun to experiment with alternatives whose service characteristics are modified to address the inflexibility and the lengthy time costs of fixed route services in suburban areas. Across the country many systems are operating or contracting for services generally called paratransit for both work and non-work trip needs. Such options are non-traditional in both their service patterns and in the fact that they often actively involve the **private sector**.

This study was directed at 1) identifying non-traditional options which had been developed for highly suburban areas, 2) developing a method allowing transit operators to identify which non-traditional services might be appropriate for which areas given local

Table 6

Work Trip Commute by Destination, 1980

(% of Market)

Live In	All	Work in Central City	Work in Suburbs	Work in Outside Area
Central City	14.3	16.1	5.5	7.3
Suburbs	4.1	8.0	1.6	7.6
Outside Area	0.8	2.5	0.9	0.7
All	6.4	13.0	2.1	0.7

Source: Table 3.19, Eno Foundation, Commuting in America, 1988, p. 55.

demographic, land-use, and geographic factors, and 3) further developing a methodology which would allow transit operators to evaluate the cost-effectiveness of various methods of providing non-traditional options (from direct public delivery to contracting for service to allowing private operators to provide competitive services).

In order to carry out the first step--identifying non-traditional options--the Study Team first identified successful options discussed in the literature or known in part to the Team. Next, the Team undertook a comprehensive survey of 22 mid-sized American cities to determine a) how extensively non-traditional services had been adopted by cities across the country, and b) if additional options or combinations of options had been developed locally which had not been widely discussed. These findings are discussed in the next section.

NOTES

1. Eno Foundation for Transportation, <u>Commuting in America; A National Report on Commuting Trends and Patterns</u>, by Alan Pisarski, Westport, Conn: The Eno Foundation, 1987

2. John D. Kasarda, "Population and Employment Change in the United States: Past, Present, and Future," in National Academy of Sciences, <u>A Look Ahead: The Year 2020</u>, Special Report 220, Washington, DC: National Research Council, 1988, pp. 98.

3. Eno Foundation, <u>Commuting in America</u>, p. 27.

4. Sandra Rosenbloom, "The Mobility Needs of The Elderly," in National Academy of Sciences (eds.), <u>Transportation in an Aging Society</u>, Vol. 2, Special Report 218, Washington, DC, National Research Council, 1988, p. 27.

5. Rosenbloom, "The Mobility Needs of The Elderly," <u>op. cit.</u>

6. Kasarda, "Population and Employment Change in the United States," <u>op. cit</u>.

7. Kasarda, "Population and Employment Change in the United States," <u>op. cit.</u>

8. Kasarda, "Population and Employment Change in the United States," <u>op. cit</u>.

9. See the Eno Foundation for Transportation, <u>Commuting in America; A National Report on Commuting Trends and Patterns</u>, by Alan Pisarski, Westport, Conn: The Eno Foundation, 1987; and, Robert Cervero, <u>Suburban Gridlock</u>, Rutgers, NJ: The State University of New Jersey, 1987.

10. Eno Foundation, <u>Commuting in America</u>, p. 4

11. Eno Foundation, <u>Commuting in America</u>, pp. 29-31.

12. Eno Foundation, <u>Commuting in America</u>, <u>op. cit.</u>, p. 48.

13. Sandra Rosenbloom, "Why Working Families Need A Car," in Martin Wachs, (ed.), <u>The Car and The City</u>, Berkely: University of Californai Press, 1991 (in press).

14. Rosenbloom, "Why Working Families Need A Car," <u>op. cit</u>.

15. Eno Foundation, <u>Commuting in America</u>, <u>op. cit.</u>, p. 57.

16. Cervero, Suburban Gridlock, op. cit., pp. 12-13.

17. Sandra Rosenbloom, "Trip-Chaining Behavior: A Comparative and Cross-Cultural Analysis of Complicated Travel Patterns of Working Mohters," in Laurie Pickup and Peter B. Godwin (eds.), Gender Issues in Transport, London: Gower Press, 1990.

18. Robert Cervero, "Unlocking Suburban Gridlock," Journal of the American Planning Association, Autumn 1986, p. 391.

19. Cervero, "Unlocking Suburban Gridlock, op. cit., p. 390.

20. Cervero, "Unlocking Suburban Gridlock," op. cit., p. 391.

21. Kasarda, "Population and Employment Change in the United States," op. cit.

22. Cervero, "Unlocking Suburban Gridlock," op. cit., p. 390.

INVENTORY OF NON TRADITIONAL TECHNIQUES

INTRODUCTION

The purpose of this phase of the study was to identify promising non-traditional transit options which could meet the variety of work and non-work needs which have emerged in suburban areas. In addition, the study was interested in how well ideas about successful and/or highly publicized transit alternatives had been disseminated to, and adopted by, transit operators across the country.

The specific focus of this investigation was mid-sized American cities (with a 1980 population between 200,000 and 650,000) with fairly low density and a dependence on the private car. Such mid-sized cities present institutional, demographic, and economic situations fairly typical of those facing a majority of the nation's transit operators; it may be unwise to try to import ideas from New York City or Los Angeles to these cities.

The study found that although there were a number of promising non-traditional alternatives available--many actually pioneered by small or mid-sized cities--they were not widely practiced by the transit industry. While it is always difficult to assess why something hasn't happened, many knowledgeable observers believe that institutional barriers and historically low transit ridership have prevented many mid-sized transit operators from either seeing the need to change or actually making such changes.

The first part of this section describes <u>prototypes</u> of non-traditional **<u>transit</u>** alternatives on which the study focused. The following sub-section describes the results of the national survey of 22 mid-sized cities.

NON-TRADITIONAL TRANSIT PROTOTYPES

The study focused on identifying and evaluating actual local experiences with non-traditional options which required the <u>active involvement or participation of the transit authority</u>. Clearly, many such options, from vanpooling to commuter buses, have been undertaken without the local transit authority playing any role whatsoever. However the purpose of the study was to find ways for **local transit operators** to become involved in the financing or delivery of non-traditional options as <u>alternatives</u> to fixed route services in suburban areas.

<u>Introduction</u>

The study investigated <u>five</u> broad categories of non-traditional options which had been undertaken or financed by <u>transit authorities</u>: *

<u>Vanpool Promotion and Leasing</u>

a) actively organized and/or promoted by the transit authority;

---

* The study <u>did not consider</u> as a non-traditional option the use of <u>vans</u>--in lieu of larger coaches--with public agency drivers providing <u>line-haul</u> fixed route service; some systems, Norfolk, for example, do consider this kind of service to be route substitution, although this study does not.

b) organized by the transit authority using authority vehicles in whole or part;

Route Substitution

a) vanpools subsidized (in whole or part) by the transit authority to substitute for existing low ridership traditional routes

Late Night, Week-end, and Low Density Services

a) provided under contract to the transit authority by taxis or other private operators

Feeder Services to Fixed Route Transit

a) taxis or other private operators under contract to the transit authority to serve transfer points, terminals, etc.

Community-based services

a) taxis under contract to the transit authority providing community based transit services, either demand-responsive or flexibly routed;

b) taxis accepting user-side subsidies (coupons, vouchers, etc) provided by the transit authority to the **general** travelling public; and,

c) flexibly routed services centered on suburban commercial and employment complexes, generally with smaller, lower floor, vehicles, sometimes provided by private operators under contract to transit authorities.

There are, of course, endless variations on these themes; moreover several community based systems developed from services which were intended as route substitution or feeder to line-haul transit services. However, Table Seven displays well-known or interesting empirical examples of these non-traditional options; each is briefly discussed below.

Community Based Services

A number of cities and transit authorities are currently providing neighborhood or community based services contracted with private, generally taxi, operators. Many of the best known systems are in California, as Table Seven shows, because that state has several sources of funding which support special general public systems in small communities--and there are a number of small suburban jurisdictions in most major metropolitan areas. In these cases, services are generally limited to the corporate boundaries of the cities, sometimes serving as feeders as well.

Both Norfolk and Phoenix are providing such services in low density, suburban parts of their communities. Both communities used these contract services to substitute for existing or planned traditional services because contract costs were less than actual/projected transit costs. Both communities anticipated more use of the services as feeders to major line-haul fixed route services but that feeder function never really developed. Planners there recognized fairly early that there was a real demand for travel to local shopping malls, etc.

Table 7

Proto-types of Non-Traditional Transit Service

Community Based Paratransit

Contract Service Delivery

- Pomona Valley Transit Authority (Calif.)
- Tidewater Transportation Development Commission (Norfolk, Va.)
- Phoenix Transit (Ariz.)
- Foothill (Los Angeles County) Dial-a-Ride (Calif)
- Orange County Transit District (Calif.)
- Palos Verdes (Los Angeles County) Transit (Calif.)
- Redondo Beach/Hermosa Beach Transit (Calif.)
- Bell Gardens (Los Angeles County), (Calif.)

Route Substitution

- Space Coast Area Transit (Brevard Cty. Fla.)
- Memphis Area Transit Authority (Tenn)
- Tidewater Transportation Development Commission (Norfolk, Va)
- Phoenix Transit (Ariz.)

Table 7 cont'd

Proto-types of Non-Traditional Transit Service

Vanpool Promotion and Leasing

- Nashville Transit Authority
- Space Coast Area Transit (Brevard Co. Fla.)

Late Night, Week-end, Low Density Service

- Ann Arbor Transportation Authority (Mich)
- Phoenix Transit (Ariz)
- San Diego Transit (Calif.)
- Tidewater Transportation Development Commission (Norfolk, Va)

Feeder Service

- San Diego Transit (Calif.)

Route Substitution

A small number of communities have been able to use either vanpools--subsidized or not--or contract taxi services to directly substitute for low volume traditional routes. Tidewater TDC is using these services to pick up the ends of long routes, and "bits and pieces" created by route changes occasioned by the implementation of their timed transfer system.

The most developed vanpool program is provided by Space Coast Area Transit in Brevard County, Florida which has a network of vanpool routes which have gradually replaced its fixed route services. Brevard contracts with VPSI, the national vanpooling company, to operate and maintain transit authority vans.

Vanpool Leasing and Promotion

While there are a number of large, well-known vanpool and ridesharing programs in metropolitan areas, few are run by transit authorities themselves. But both Nashville and Space Coast Transit are interesting exceptions. Both purchase vehicles with Urban Mass Transportation Administration funds and in turn lease them to people starting vanpools; Nashville directly operates this program while, as mentioned above, Space Coast in Brevard Florida contracts with VPSI to run the pooling program. The important point is that both properties consider the delivery of such services to be their mandate--and a logical way to meet low density suburban needs in an auto-dependent society.

Late Night, Week-end, and Low Density Services

The system shown in Table Seven all use contract taxi operators to provide service at times or in areas where traditional transit services are not feasible. Strikingly, all four of these systems have been doing so for roughly ten years. Although analysts have suggested these ideas for over a decade, and these systems have used them successfully for a substantial time period, few other cities seemed to have joined their number.

Ann Arbor competitively contracts with one local taxi operator to provide all-night service; these services have been popular with women working the late shift at nursing homes and hospitals. Phoenix and San Diego use contact operators to provide Sunday or holiday service in lieu of their regular fixed route services in the area because the contract costs are substantially less than paying holiday rates to drivers. San Diego also uses contract operators to act as feeders from rural areas of the service area to line-haul transit routes.

SURVEY OF MEDIUM SIZED CITIES

This part of the study was designed to see how extensively and well the promising ideas discussed above--**the prototypes**--had been adopted by a sample of twenty-two medium sized cities. Additionally, the survey was designed to identify other non-traditional alternatives in use by medium sized cities seeking to meet their suburban transportation needs.

Overall, few cities were involved in any of the prototypical services described above. Austin, Texas, quite co-incidentally, was doing by far the most, with Greensboro, NC, operating a vanpool leasing program like the prototypes in Nashville, etc. But most cities were not doing anything vaguely non-traditional. Moreover several cities reported that they felt such alternatives were not their responsibility; some even reported that such activities were illegal for transit operators!

Survey Background

Table Eight displays the 22 cities chosen for survey; they were selected to represent a national range of medium sized, low density cities, facing many similar problems but also markedly different problems--differing weather conditions, labor markets, and traditional transit use.

Each city was telephoned from three to seven times to obtain a range of information, including the type of non-traditional services offered, the dynamics of those services, the cost and service patterns, and ridership and other operational experiences. The study was hampered by the fact that many cities have some form of ridesharing or carpool matching program, although it rarely had anything to do with the transit operator; the Study Team was often repeatedly referred to these programs before being able to contact transit officials who could discuss their role in vanpooling and other non-traditional programs.

Once initial surveying was complete, each respondent in each city was sent a written assessment of the information gathered (and presented in the Table and Figures in this section) and asked to comment on the accuracy of the data. In general 18 cities provided enough information, after repeated telephone contacts, to be included here.

Findings

Table Nine shows how limited were the activities of most transit systems with regard to the vanpool prototypes discussed above. Most transit operators in these communities had little to do with vanpooling other than not protesting the operation of vanpools started by other agencies (as they might have done under their PUC/operating mandates and which transit operators did 10-15 years ago). Only Austin, TX and Greensboro, NC had current programs; Orlando, Fla. and New Haven, Conn. were considering minor involvement in vanpool programs.

Table Ten describes the specific activities of the four transit operators with any vanpool involvement. Austin is clearly using vanpools for a variety of purposes; Greensboro is only operating a more or less traditional vanpool program although the vehicles being used are purchased with through regular UMTA capital grant programs. Knoxville has worked with the local (and nationally well known) vanpool/rideshare matching program to deal with the needs of riders affected by transit service cancellation and Orlando is compiling a grant request to fund a small scale test of a leasing program.

Table Eleven summarizes the activities of Austin and Greensboro--the only cities with any meaningful non-traditional involvement by transit operators. Table Twelve describes the cost patterns for both the transit systems and individual riders in both systems. The situation is confused a bit by Austin's recent adoption of a totally fare-free transit system so the cost data are given for service prior to that policy. In both cities the largest element of subsidy is the vehicle itself; the riders cover most of the other costs.

Table 8

Characteristics of Twenty Survey Cities

Service Area	1980 Service Area Population	1989 Est. Service Area Population*	Work Trip Modal Split
• **Albuquerque N.M.**	(486,200)**	394,000	2.6
• **Allentown Pa.**	666,000	525,000	3.1
• **Austin Tx.**	419,000	604,000	4.0
• **Bakersfield Ca.**	222,000	296,000	1.3
• **Baton Rouge La.**	(572,800)**	——	1.6
• **Charleston S.C.**	(502,100)**	——	3.1
• **Fresno Ca.**	331,000	430,000	3.0
• **Grand Rapids Mi.**	375,000	385,000	2.6
• **Greensboro N.C.**	170,000	190,000	3.8
• **Harrisburg Pa.**	(583,700)**	278,000	5.0
• **Jacksonville Fla.**	571,000	700,000	5.1
• **Knoxville Tn.**	175,000	173,000	3.7
• **Las Vegas Nev.**	463,000	700,000	2.0
• **Little Rock Ar.**	294,000	280,000	2.0
• **New Haven Ct.**	(519,000)**	——	6.9
• **Orlando Fla.**	700,000	747,000	1.8
• **Syracuse N.Y.**	464,000	500,000	7.7
• **Toledo Oh.**	354,000	375,000	4.1
• **Tucson Az.**	(619, 400)**	589,082	3.4
• **Tulsa Ok.**	(733,000)**	375,000	2.7
• **Youngstown Oh.**	383,000	225,000	1.0

* Obtained from individual respondents

** 1980 MSA Population

Table 9

Transit System Role in Promoting Local Vanpools

City/MSA	Basic Role	Marketing/ Advertising/ Promoting	Matching Programs	All or Part of Vehicle Costs*	Insurance (full or part)	Vehicle Maintenence (full or part)	All or Part of Operating Costs	Other Subsidies
• Albuquerque	No Active Role	—	—	—	—	—	—	—
• Allentown	No Active Role	—	—	—	—	—	—	—
• Austin	Active Van Program	Yes	Yes	Yes	Included	Included	Yes	Totally fare free/ admin. costs not charged to riders
• Bakersfield	No Active Role	—	—	—	—	—	—	—
• Baton Rouge	Under Consideration	—	—	—	—	—	—	—
• Charleston	No Active Role	—	—	—	—	—	—	—
• Fresno	No Active Role	—	—	—	—	—	—	—
• Grand Rapids	No Active Role	—	—	—	—	—	—	—
• Greensboro	Active Van Program**	Yes	Yes	Yes	Yes	Yes	—	Administrative costs not charged to riders
• Harrisburg	No Active Role	—	—	—	—	—	—	—

* includes nominal rentals/leases

** The City of Greensboro using UMTA Sec. 9 money; a private utility operates the transit system wih no federal or city funds

Table 9 Cont'd

Transit System Role in Promoting Local Vanpools

City/MSA	Basic Role	Marketing/ Advertising/ Promoting	Matching Programs	All or Part of Vehicle Costs*	Insurance (full or part)	Vehicle Maintenence (full or part)	All or Part of Operating Costs	Other Subsidies
• Jacksonville	No Active Role	—	—	—	—	—	—	—
• Knoxville	Cooperate in Promotion	—	—	—	—	—	—	—
• Las Vegas	No Active Role	—	—	—	—	—	—	—
• Little Rock	No Active Role	—	—	—	—	—	—	—
• New Haven	Seed Money for Low-Income Worker's Vans	—	—	—	—	—	—	—
• Orlando	Provide Matching Assistance to Private Vans	Yes	—	—	—	—	—	Subsidizing driver and vehicle for reverse commute service
• Syracuse	No Active Role	—	—	—	—	—	—	—
• Toledo	No Active Role	—	—	—	—	—	—	—
• Youngstown	No Active Role	—	—	—	—	—	—	—

* includes nominal rentals/leases

Table 10

Nature of Transit System Involvement in Vanpooling

City/MSA	Replace Existing or Planned Routes with Unsubsidized Vans	Replace Existing or Planned Routes with Subsidized Vans	Vehicle Lease Program to		Other Subsidies to New or Continuing Pools
			Individuals	Firms	
• Austin	No	Yes	Yes	Yes	Yes
• Greensboro	No	No	Yes	Yes	Yes
• Knoxville	No	Transit Authority worked with rideshare agency to create pools for riders on 3 terminated routes	No	No	No
• New Haven	No	Working with rideshare agency to turn subsidized reverse commute bus pool into regular vanpool	No	No	No
• Orlando	No	No	Has grant proposal to fund demonstration program	No	No

Table 11

Use of Non-Traditional Options

Austin

- vanpool route substitution
- subsidized vanpools
- personalized commuter service
- guaranteed taxi-ride home
  (for service area vanpools and park-N-ride passengers)
- taxi route-substitution
- taxi feeder service

Greensboro

- subsidized vanpools

Table 12
Cost and Service Patterns of Transit Sponsored Vanpools

	Austin*	Greensboro
• Type of Pool	Third Party Operating Contract (VPSI)	Direct Service; leasing agency vans
• Number of Worksites/Pools	6	14
• Number of People	60	196
• Total Costs		
Per Vehicle/Pool/Month	$685 including gas, maintenance and insurance	$250/8 passenger van [4] $299/15 passenger van [4]
Per Vehicle Mile	$0.56 [1]	$0.16
Per 1-way Passenger Trips	$1.56 [2]	$0.25 (15 pass. vans)
(Costs do not include)*	transit system administration	transit system administration, vehicle acquisition and depreciation
• Cost to Passenger	Varies; [3] average $34/month	Varies; 15 passenger van [4] approx. $21.36 8 passenger van [4] approx. $31.29

1 assuming the average 56 mile RT

2 assuming the average vehicle occupancy of 10

3 set to equal fare for monthly express bus service pass

4 for 20 mile RT

* cost data are prior to initiation of fare-free transit policy

IMPLICATIONS

These findings are fairly depressing. Even though promising prototypes exist, and have been successfully used by both large and small communities, they have not been widely adopted by medium sized transit operators. Part of the problem is that traditional transit planning methods are focused on identifying corridors of demand for line-haul fixed services. The methods are inadequate and ignore the range of suburban needs faced by most travellers in modern cities; the next section of the study and report address this issue.

COST EFFECTIVENESS
AND
IMPLEMENTATION METHODOLOGY

INTRODUCTION

The first substantive section of this report discussed the rapidly emerging travel needs of suburban residents, needs not well met by traditional transit services. The following section identified a range of non-traditional service options which have proved successful in other communities in meeting suburban work and non-work travel needs. This section describes a six step method which will allow local operators to develop a comprehensive and cost effective service strategy for suburban transit development, given the difficult suburban environment and the existence of viable service options.

The methodology has two major thrusts: **first**, it gives operators a way to match potential transit and paratransit options to the range of travel needs identified in suburban areas, and **second**, it allows operators to consider the cost effectiveness of various ways of delivering those service options, including the active involvement of the private sector.

The methodology is designed a) to work with locally available data or national proxies, b) to require only simple calculations (easily performed using a spreadsheet but do-able by hand if necessary), and c) to give reasonable results which can be used to develop demonstration or small scale projects if the transit authority desires to "start small."

The following sub-sections describe each Step in detail and explain the kind and source of data needed to perform necessary calculations. The following major section of this report shows how this methodology was used in Austin, Texas to identify suburban travel needs, evaluate alternative ways of meeting those needs, and then suggest specific strategies for implementing cost-effective alternatives.

OVERALL APPROACH

The methodology is designed to identify groupings of work and non-work trip generators and attractors, to match those needs to promising service options, and to evaluate the costs of various ways of delivering those options (eg. by the public sector, by the private sector with financing by the public sector, or by the private sector alone, as a profit making venture.)

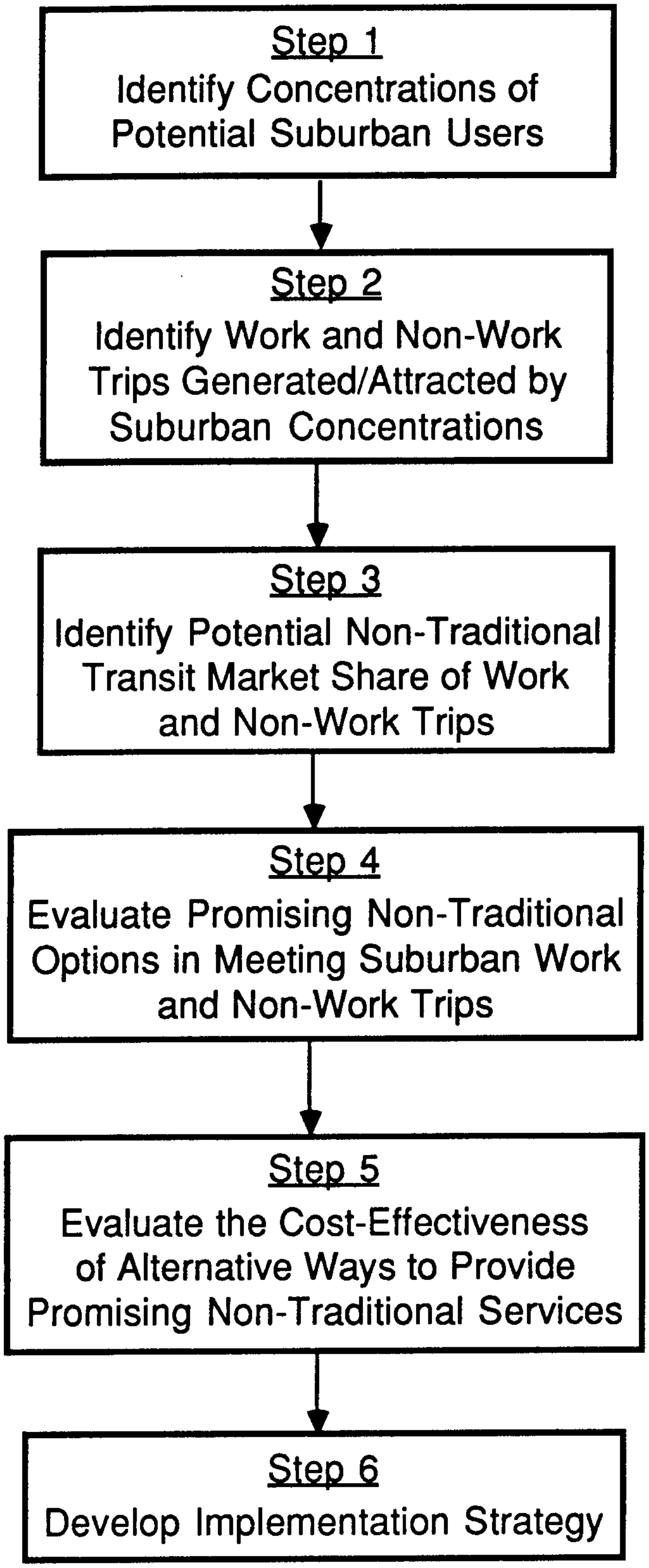
The methodology has several major features. First, it differentiates between work and non-work trips and calculates each quite differently; it focuses on the destination of work trips but the origins of non-work trips. Second, the method stresses the need to find ways to overlap work and non-work service options in response to the mid-day non-work travel needs of workers who use non-traditional transit options.

Third, the approach stresses identifying suburban concentrations of employment, shopping, commercial, and medical activities near suburban residential areas, in order to develop **community based** service options. The approach abandons radial corridors or limited trip attractors in favoring of identifying natural transit catchment areas for non-work trips around suburban commercial clusters.

The methodology has six steps as illustrated in Figure II. Step 1 identifies a) residential areas with concentrations of people likely to use non-traditional transit services, especially for non-work trips, and b) major employers or employment clusters. Step 2 calculates a) the non-work trips generated in the suburban residential areas and b) work trips attracted to the major employers.

Figure II

Summary of Six-Step Non-Traditional Transit Assessment Methodology



Step 3 estimates what percentage of the work and non-work trips in each concentration or employment cluster are likely to use non-traditional transit services, while Step 4 evaluates how well promised non-traditional transit options might meet those needs. Step 5 calculates the cost of various ways of providing locally promising options, while Step 6 details how to develop implementation strategy.

Each of the steps, and the data required for the analyses, are discussed in detail below.

STEP ONE - IDENTIFY CONCENTRATIONS OF POTENTIAL SUBURBAN USERS

The main purpose of this Step is to identify potential work and non-work trip attractors around which non-traditional transit services can be focused. To do so, the Step approaches work and non-work trips very differently because different methods must be used to calculate each. Figure III shows the sequential and overlapping sub-tasks in Step 1; they are described below.

STRATEGY

Employment Concentrations

The basis of this approach is that non-traditional options only work well for work trips when they are organized for, or focused on, INDIVIDUAL employment sites; vanpooling and non-family carpooling are only meaningful alternatives for those employed at the same place. Therefore the overall methodology first identifies major employment sites

To begin (**1B(1)**, **1B(2)**) the transit operator must identify both large individual suburban employers, and, clusters, parks, or complexes which house multiple industries and employers. Although retail establishments in strip developments (ie. along major roadways) are common, retail establishments are not good candidates for non-traditional employment services because shifts and hours vary greatly.

Next, (**1B(3)**) the transit operator must find out or calculate the number of employees arriving at each employment site during each shift. Finally, (**1B(4)**) the transit operator must clearly identify which areas or complexes are large enough to consider the implementation of non-traditional services.

Residential Concentrations

These calculations assume that it is possible to identify residential areas with high concentrations of both traditional and non-traditional transit users using readily available data. Such neighborhoods make good "targets" for the provision of non-traditional services for non-work trips.

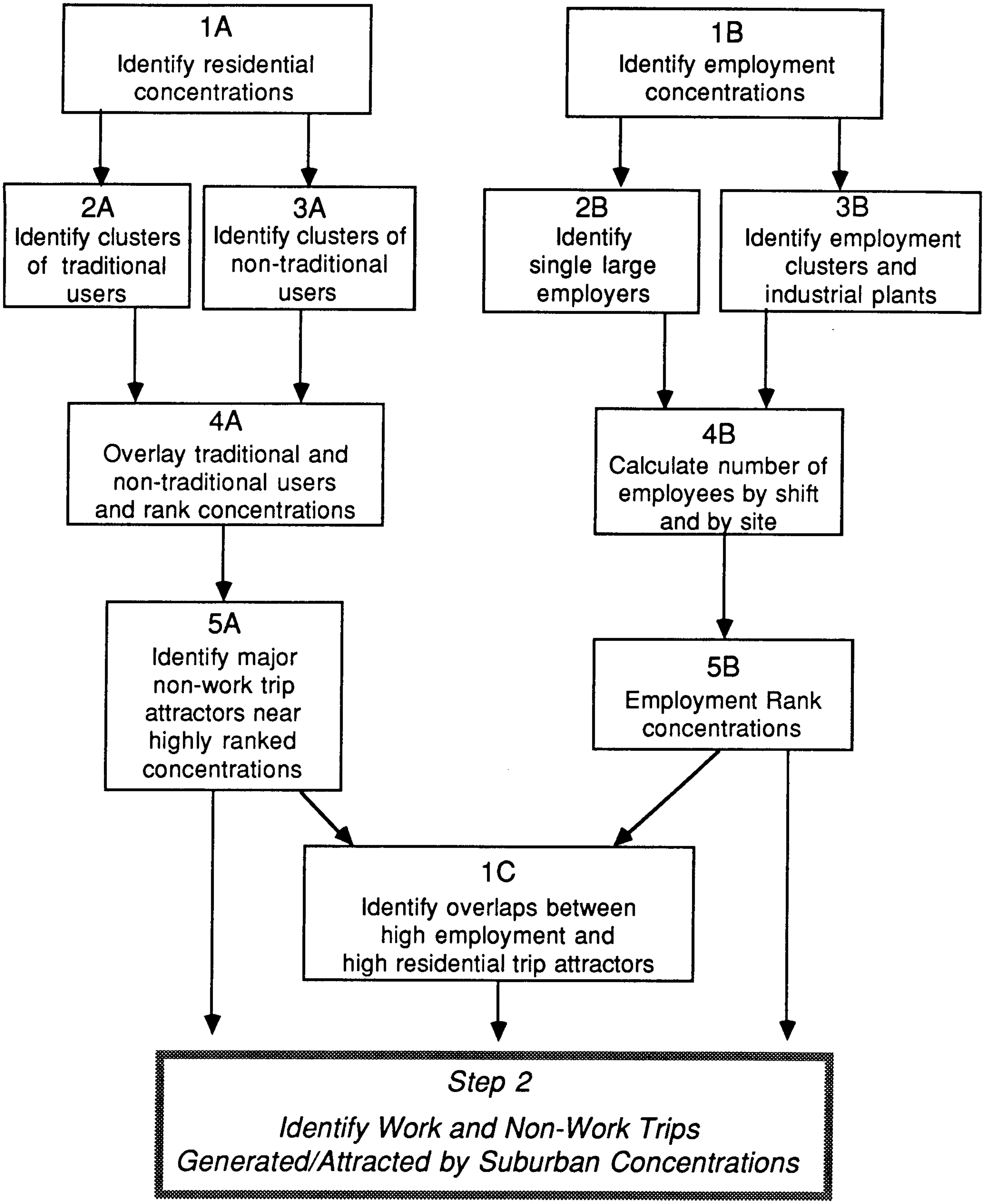
First, the transit operators must identify census tracts or traffic serial zones with high numbers of the people who have traditionally been heavy users of public transit (**1A(1)**):

-elderly individuals or households
-low income individuals or households
-work disabled individuals
-unemployed individuals (or areas with high unemployment)
-carless households

Figure III

Step 1

Identify Concentration of Potential Suburban Users



Next, the transit system must identify households with less traditional but still needy riders (1A(2)):

-single heads of households with children
-children 6-15
-two worker households with only one car
-elderly with transit disabilities

Once these tasks are completed, the transit operator has to identify areas with high suburban concentrations of either traditional or less traditional riders, and preferably overlapping concentrations (1A(3)).

Once these suburban residential concentrations are identified, they must be matched to major suburban commercial, retail, and medical concentrations (1A(4)). These complexes can be identified using the same methods used to identify and locate major employment concentrations.

Since it is highly desirable to combine or overlap work and non-work services (in order to make the non-traditional work services viable), the final sub-task of Step 1 is to try to find parts of the community where both employment and commercial/retail/medical concentrations are found together or close to one another. This focus can also facilitate serving <u>work</u> trips generated within the surrounding residential areas going either to the employment concentrations or jobs within the commercial centers*.

DATA REQUIRED

<u>Employment Concentrations</u>

Table Thirteen shows how the transit operator may obtain the necessary data. In general, city planning and transportation planning agencies (at several local levels of government) have identified major employment sites; Chambers of Commerce and local property management companies generally keep lists of the largest employers or complexes (with addresses). If all these sources fail, the transit operator can pick a section of the suburban portion of its service area and undertake a windshield survey--<u>ie</u> drive the streets mapping large employers/concentrations.

Once sites are identified, the transit agency can ask each employer to supply the number of employees <u>per shift</u> (and their addresses or zip codes to be used in Step 2). This information is generally very easy to obtain from large single employers. Property management firms also tend to have good estimates of the number of employees working at complexes or parks.

Direct employee information will not be available for all employment sites so the transit operator must use proxies in Step 2 to estimate employee trips to other sites.

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* Again, while commercial, medical, and retail centers often offer many jobs, the hours/schedules <u>etc</u> vary so greatly that vanpooling and other non-traditional <u>work</u> options are not very successful. In addition the low pay also means that employees come from nearby since most people will not travel far for low paying, part-time jobs, particularly with erratic scheduling.

Table 13

Sources of Data Needed for Step 1

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
1A Identify residential concentrations	• suburban residential areas near employment or commercial clusters • free-standing residential areas	• planning agency • transportation planning agency • windshield surveys • local realtors • Census data	None
1B Identify employment concentrations	• large suburban employers • suburban industrial or commercial complexes • industrial or commercial concentrations	• planning agency • transportation planning agency • windshield surveys • local realtors • economic development agency • Chamber of Commerce	None

Table 13 cont'd

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
2A Identify clusters of traditional transit users	• suburban areas with high concentrations of young, old or poor people or autoless households • suburban areas with high traditional transit ridership	• transit authority • transportation planning agency • Census data at tract level • local transit marketing studies or surveys	None
	Actual employment data		
4B Calculate employees by shift and site	• the number of employees working at each specific large employment site, by shift • the number of employees working in complexes and commercial areas (where individual enumeration is not possible/practical)	• individual employers • city planning agency • economic development agency • Chamber of Commerce	None

Table 13 cont'd

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
4B cont.	<u>If actual employment data are not available</u>		
	• square footage by land use type and A.M. peak • employment trips per square foot	• local developer • city planning agency • property management companies • calculate with a planimeter on zoning maps (confirmed by windshield surveys) • local studies of traffic generation rates at comparible facilities	• ITE Traffic Generation Model (gives emp. trips per sq. foot of various land uses for AM peak)
5A Identify major non-work trip attractors	• commercial, shopping and retail centers, and strip developments	• local developers • city planning agency • property management companies • city maps and phone books • windshield surveys	None

Residential Concentrations

As Table Thirteen also shows, most of the data needed for the analyses in **1A**, are readily available, at a minimum from published census reports at the tract level. However, in many communities, the local or regional transportation planning agency(ies) has already performed demographic analyses of this kind, usually at the traffic serial zone level**. It is important not to duplicate work already done locally. The transit operator can either use tabular or already mapped data from these studies/agencies to identify residential concentrations of both traditional and less traditional riders.

Local and metropolitan planning and transportation planning agencies may already have done even more fine-grained studies or supplemental analyses of potential transit usage--the transit operator should also take advantage of these findings.

If the transit operator is very certain that these kind of demographic analyses have not already been completed locally, the U.S. Census will provide all necessary information. After 1990, Census data will be available in both published and machine readable forms and the transit operator may wish to develop competence in dealing with the computer-based forms of data (which will be, ultimately, easier to use, and more flexible, than published tables).

In general, the same sources used to locate large employment concentrations can be used to identify large suburban commercial/medical/retail concentrations for task **1A(4)**. The transit operator can call on planning and transportation planning agencies (at several local levels of government), the Chamber of Commerce, and local property management companies to identify commercial complexes. If all these sources fail (or to augment available information), the transit operator can use phone book listings combined with a windshield survey--ie drive the streets checking listed stores, etc and mapping large concentrations.

STEP 2 -IDENTIFY WORK AND NON-WORK TRIPS GENERATED/ATTRACTED BY SUBURBAN CONCENTRATIONS

The objective of this Step is to calculate or estimate the number of work trips attracted daily to each major work site, and, the number of non-work trips generated in highly rated suburban concentrations. As above, work and non-work trips are calculated and treated differently. The data derived in this task are used in Step 3 to estimate potential transit ridership for non-traditional alternatives.

Figure IV shows the individual sub-tasks comprising this Step.

STRATEGY

Employment Concentrations

For those sites where actual employment numbers by shift are known, the transit operator can simply assume that each employee makes **one** trip **to** the facility each working day.

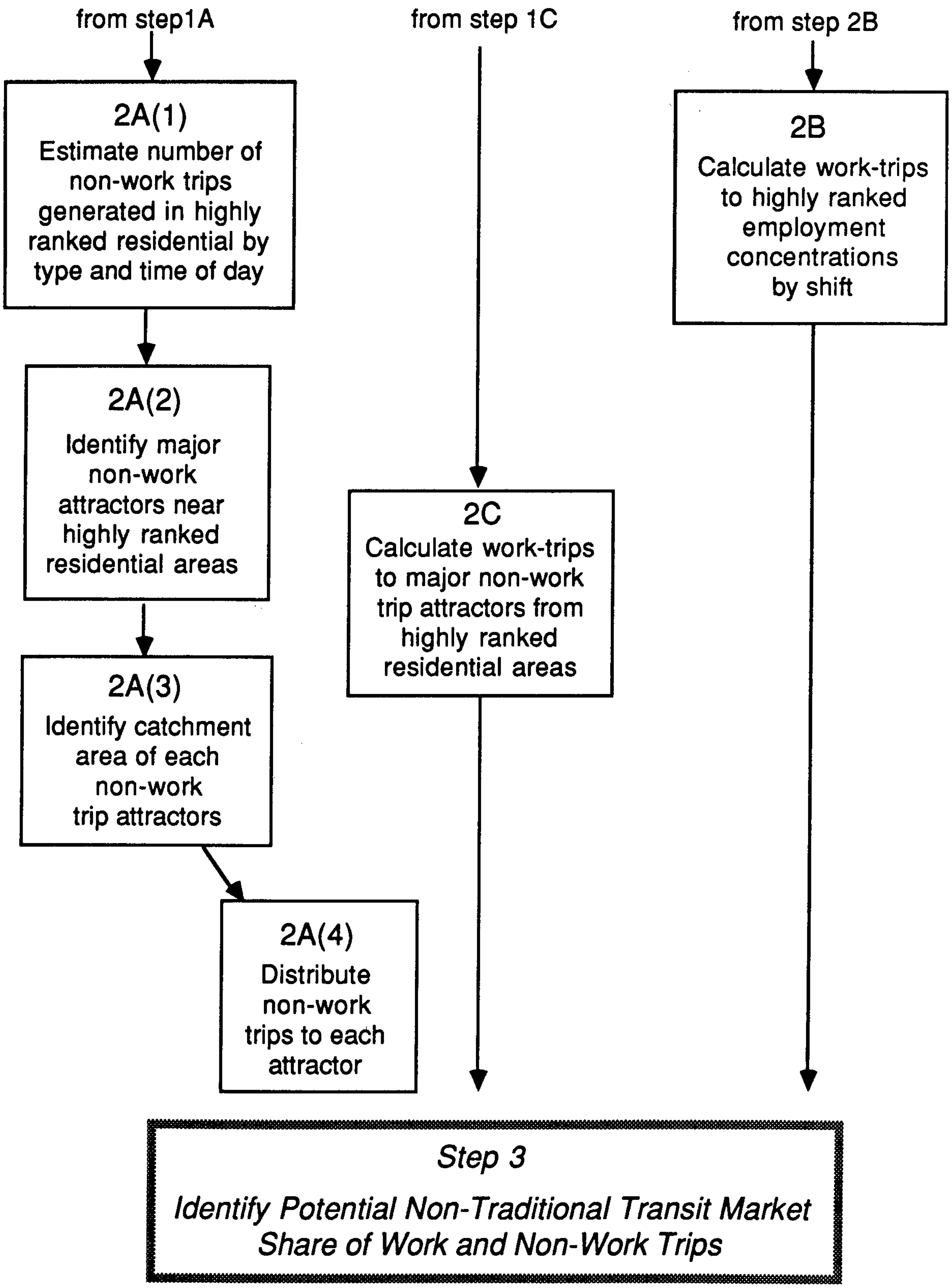
Obviously, direct employee information will not be available for all employment sites so the transit operator must use **proxies** to estimate employee trips to other sites.

** The traffic serial zone is the accepted unit of analysis in transportation planning; in suburban areas there are usually 3-5 traffic serial zones in one census tract.

Figure IV

Step 2

Identify Work and Non-Work Trips Generated/Attracted by Suburban Concentrations



Residential Concentrations

The basis of this approach is that most non-work trips are made relatively close to the traveller's home. Therefore, once the number of non-work trips generated daily in promising suburban areas is calculated (**2a(1)**), most can be distributed to nearby commercial, retail, and residential areas (**2A(4)**. Ultimately these data will suggest suburban **community service areas**, groupings of neighborhoods 15-20 miles square, which "contain" most of the trip destinations of suburban non-work trips.

In some sense, this approach imagines a set of concentric circles: the first set of circles each surround one highly rated suburban area, outlining the geographic area within which most non-work travel takes place. The second set of circles outlines the service or "catchment" area of each major commercial/retail concentration. The purpose is to overlay the concentric circles (although this can be analytical rather than graphic) in order to identify commercial centers which attract a large clientele from nearby highly rated residential areas. Such attractors are candidates for community based non-traditional transit systems.

To calculate non-work trips generated in residential areas, the transit operator must characterize the housing units in each area as a) single family, b) multi-family, and c) mobile home. Then the operator can use either existing local information on the trip generation rates of such units, or, use proxy trip generation data from the Institute of Traffic Engineers (ITE) Trip Generation Manual [1]. Once **total trips** are calculated, they must be classified as either work or non-work (and preferably finer gradations such as shopping, medical, personal business, etc.)

The non-work trips must be "distributed" among major nearby commercial, medical, and retail concentrations identified in Step 1 (Fig. IV). The appropriate concentrations are selected from among those identified in Step 1 in task **2A(2)**, their service or catchment area is defined in task **2A(3)**, and the non-work trips are apportioned among these concentrations in task **2A(4)**. If possible, the work trips generated in these neighborhoods which also go to these commercial concentrations should be identified and apportioned (Task **2C**).

DATA NEEDED

Employment Concentrations

Table Fourteen suggests local and national sources of data for the analyses undertaken in Step 2. As the table shows, when direct employment data are unavailable, local proxies may be used: employees per square foot or establishment. Failing that, the transit operator can use national proxies based on the computation of employment trips attracted to various types of facilities per square foot, using the ITE manual to generate those numbers.

To perform these calculations, the transit operator must obtain the number of square feet for each major land use in the employment clusters (ie large commercial, light industrial, manufacturing,. etc ***) **or** actually calculate those numbers. Actual numbers may be available from city planning and transportation planning agencies, from the Chamber of Commerce, and from local property management companies.

*** Begin by looking at the ITE Trip Generation Manual to see a) the various kinds of land uses for which good data are available and b) exactly how detailed the study should be.

Table 14

Sources of Data Needed for Step 2

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
2A Estimate number of non-work trips in residential areas by type and time of day	• number of acres or individual housing units by type (single-family, multi-family, mobile homes)	• transportation planning agency • planning agency • local land use surveys • calculate with a planimeter on zoning maps	None
	• hourly trips generated for shopping, medical, and personal business by given residential uses (single-family, multi-family, mobile homes per unit or acre)	• local studies of comparable neighborhoods • studies of local transportation behavior	• ITE Trip Generation Manual • NPTS data on trip purposes of non-work trips

If actual computations are necessary, zoning and subdivision maps are the best way to do so because they usually show the "footprint" of various buildings, etc so it is far easier to calculate square footage in actual use for various purposes (eg. manufacturing, etc.) If such maps are unavailable, a windshield study can be used in conjunction with a commercial map of the city to identify the approximate square footage in use in suburban employment complexes/industrial parks, etc.

Residential Concentrations

To distribute trips to nearby local commercial/retail/medical sites, the transit operator should try to use local data or studies which give, a) divide total trips by component trip purposes by percent and b) the average trip lengths of various trip types. If local data are not available on the distribution of trips by type, the total trips generated in **2A(1)** may be divided using national proxy measures from the National Personal Transportation Study (NPTS)[2]. (Published data show trip purposes by size of metropolitan area, as well as by income, car ownership, and other features which may be added to the model if desired).

Individual trips by type should be distributed to commercial concentrations using average trip length and the distribution of trips by length, data which may or may not be available locally. These data can be augmented by local marketing studies done by the commercial centers in question and studies done in similar communities. If local data on trip length are not available, NPTS data may also be used as proxies. Since not all non-work trips are made close to home not all trips will be distributed to nearby centers; they will be ignored for the purposes of this analysis.

Frankly, some judgement on the services and facilities offered by each commercial concentration is required. Moreover, some distribution will be relatively arbitrary since the analyst can have little idea how shoppers, for example, chose between two centers equi-distant from their homes (nor how travellers chose between dry cleaners, let alone doctors.) However, errors of this type should balance out.

STEP THREE - IDENTIFY POTENTIAL NON-TRADITIONAL MARKET SHARE OF WORK AND NON-WORK TRIPS

The main purpose of this Step, shown in Fig. V, is to calculate what percentage of the work and non-work trips calculated in Step 2 are likely to use non-traditional transit services. In many ways, this is the most difficult, yet important step in the methodology. An effort is made to develop a **realistic** assessment, based on both local experiences and experiences in similar communities.

Again, the Step approaches work and non-work trips very differently. Figure V shows the sequential and overlapping sub-tasks in Step 3; they are described below.

STRATEGY

Employment Concentrations

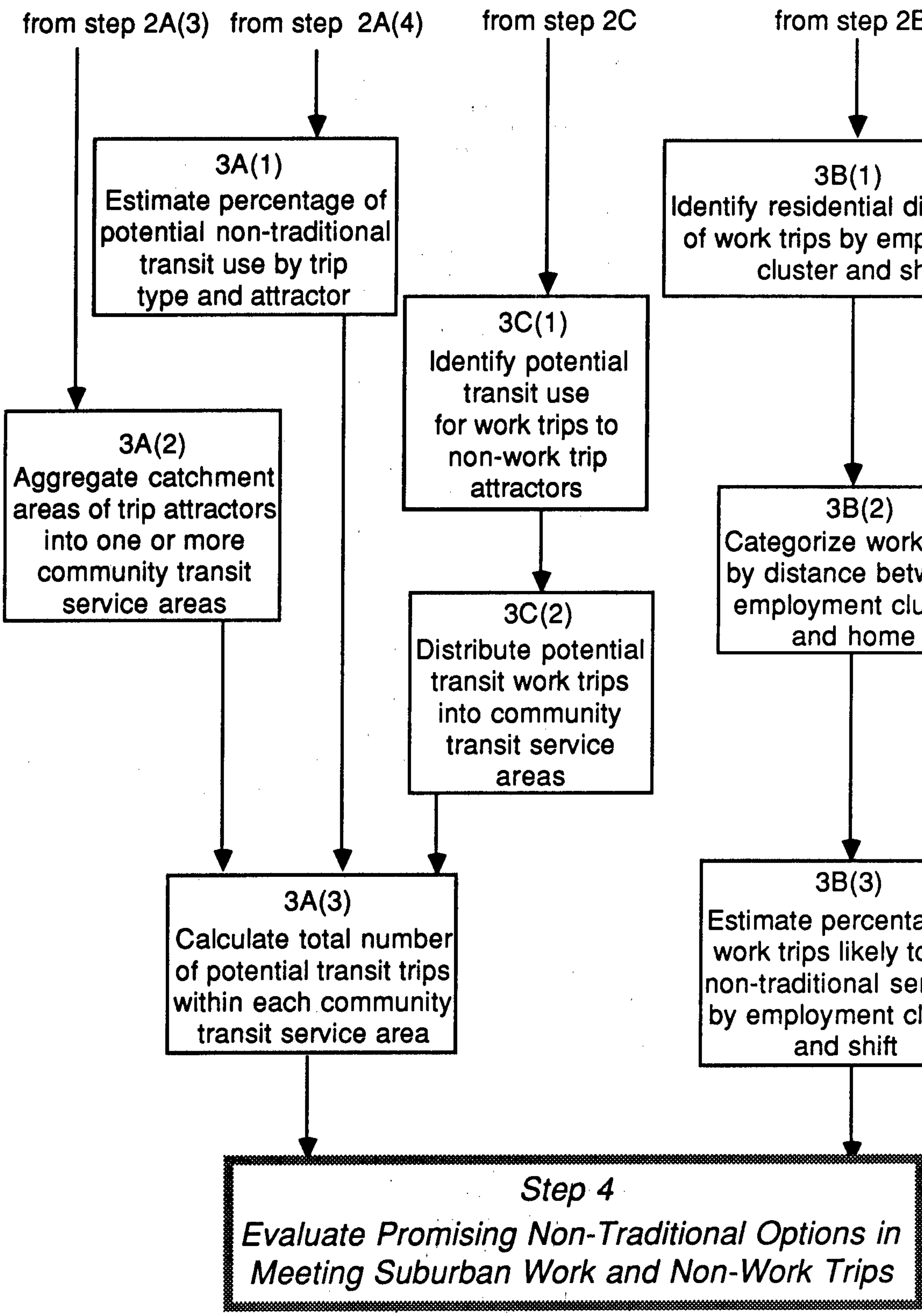
This Step assumes that riders must live a minimum of **10 miles** from their employment site, and live relatively close together, to consider using non-traditional transit options like vanpools. Moreover the approach uses experiences locally and in similar firms across the country to generate a **range** of likely ridership responses.

To begin, the transit operator must find out or estimate the residential location of all the workers at each of the major employment sites (**3B(2)**). Then those working ten or more miles from their jobs are clustered; those sites with sufficient concentrations of such

Figure V

Step 3

Identify Potential Non-Traditional Market Share of Work and Non-Work Trips



employees living near one another are identified and ranked (**3B(2)**).

Finally, using local and proxy data on the percentage of people using transit or traditional transit services, the transit operator can estimate a range of potential transit users for each employment site. The current local public modal split can be used as the low end of range; the high end can be the percentage of vanpoolers in the area's most successful individual program.

Residential Concentrations

This approach first estimates a range of ridership responses to non-work transit options (**3a(1)**), adds possible ridership responses for work trips to major commercial concentrations (**3C(1)**), and then aggregates ridership into community transit service areas (**3A(3)**). The transit operator can use existing transit use figures for non-work trips as the low end of the range, and experiences of other communities with non-traditional services as the high end of the range.

DATA NEEDED

Employment Concentrations

Table Fifteen suggests local and national sources of data for the analyses undertaken in Step 3B. In general, the transit operator will have to use a mixture of local data, national proxies, and some professional judgement. First, to calculate the residential location and distance from job of workers at selected employment sites, the analyst can use the known addresses or zip codes (easily available from large individual employers) to calculate average work trip distances, and the distribution of work trips lengths, for the suburban complexes without direct data. These can then be used as proxies, or combined with NPTS data, to generate the percentage/number of employees/trips living at various distances over 10 miles from each site.

Next, the transit operator can use Census data on carpooling and vanpooling use, local experiences with vanpooling (regardless of actual sponsor), and national studies and experiences to calculate the range of ridership responses per shift.

Residential Concentrations

Table Fifteen also suggests local and national sources of data for the analyses undertaken in Step 3A and 3C. As with task 3B the transit operator will have to use a mixture of local data, national proxies, and professional judgement.

To begin (**3A(1)**), the transit operator can use local and national experiences to estimate ridership ie percentage of trips that will use non-traditional transit options, for non-work trips within a community service area. Then, focusing on the commercial concentrations, the transit operator can define "natural" service areas (**3A(2)**): this process must balance the number of trips within each potential service area with the trip lengths involved, supplemented by any important local information about the concentrations in question (eg. mall management has asked for such services previously.) Some community transit service areas will focus on only one commercial/residential/medical complex and surrounding residential neighborhoods, while other service areas will contain more than one major concentration and its adjoining neighborhoods.

Next, the transit operator must calculate the transit use of work trips generated within each community service area destined for that service area (**3C(1)**); again a range can be developed based on current transit market share for the low end of the range and the ridership experiences of other communities for similar trips for the high end.

Table 15

Sources of Data Needed for Step 3

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
3A(1) Estimate percentage of potential transit use by trip type and attractor	• Distribution of non-work trips to potential attractors (centers, strip development, etc.)	• local data on use of shopping centers, etc. (individual stores or center management)	• ITE Traffic Generation Manual (estimate of non-work trips attracted by various commercial land uses)
		• use data supplied by property management firms and relevant business establishments (sq. footage of space by land use can also be used to develop proxy measures)	• NPTS data (on average trip lengths for non-work trips)
	• percentage of non-work trips by type potentially taken by transit to each potential attractor	• local ridership and marketing studies (planning and transportation agencies)	• NPTS data (on transit use for differerent types of non-work trips)
		• local transit ridership and on-board studies (transit agency)	

Table 15 cont'd

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
3B(1) Identify residential distribution of work trips by employment cluster and shift	• home addresses or zip codes of employees at major employment clusters	• Individual Employers	
	• distance between work and home for employees at major employment clusters	• measure on map if addresses known • average home-to-work trip length (local studies) • use known employees distribution as a "sample" and assume same distribution for unknown employees	• average home-to-work trip lengths (NPTS or Census data)

Table 15 cont'd

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
3B(3) Estimate percentage of work trips likely to use non-traditional services	• Likely vanpool or carpool modal split	• Experiences of similar local employment sites • Census data on local carpool and vanpool usage	• Census data on average suburban carpool and vanpool use • experiences at employment complexes nationally • NPTS data on suburban carpool use

These estimates should be supplemented with relevant local information; for example, a hospital employing nurses on late night shifts might be a good candidate for non-traditional services if some of the nurses lived in the transit service area.
Once these service areas have been defined, and work trips within each service area added (3C(2)), the total number of transit trips is simply summed from the individual concentration totals (3A(3)).

STEP FOUR - EVALUATE PROMISING NON-TRADITIONAL OPTIONS IN MEETING SUBURBAN WORK AND NON WORK TRIP NEEDS

The objective of this Step is to evaluate how well various non-traditional transit options would serve the work and non-work trips identified in earlier steps. The focus is on responding to the character of the trips and travellers, while being sensitive to the community environment. While work and non-work trips probably will not be served by the same option (although it may be considered locally), a major goal of this Step is to evaluate how work and non-work alternatives could support one another, for example, by providing mid-day travel options for those using vanpools to work.

Figure VI shows the sequential and overlapping sub-tasks in Step 4; they are described below. All data required for analysis have been generated in previous steps. The results of this Step feed directly into Step 5, which describes the strategy for evaluating the cost effectiveness of appropriate options.

While Steps 4 and 5 are shown as sequential and separate, they may become iterative if an appropriate option cannot be provided locally (or for a cost-effective price). A transit system may also wish to consider the analyses in these two Steps together, analyzing costs at the same time that a service "match" is sought.

STRATEGY

Employment Concentrations

In Task **4B** the transit analyst considers how a range of ride-sharing options could be implemented or supported by the transit operator to meet the range of travel needs identified earlier. Of course ride-sharing is hardly a novel concept, but the active involvement of the transit operator is far less common. The options include but are not limited to: transit system ownership of vehicles leased or lent to individuals/companies establishing pools, transit system promotion of company based programs, contract vans replacing existing or planned suburban routes serving those complexes, and other transit system partial subsidy of individual vanpools (eg inner city reverse commute programs).

The approach stresses giving highest priority to 1) very large firms, particularly with many employees commuting significant distances, and 2) employment concentrations near commercial/retail/medical concentrations. The latter supports the goal of re-enforcing non-traditional transit use for work trips by providing mid-day travel options.

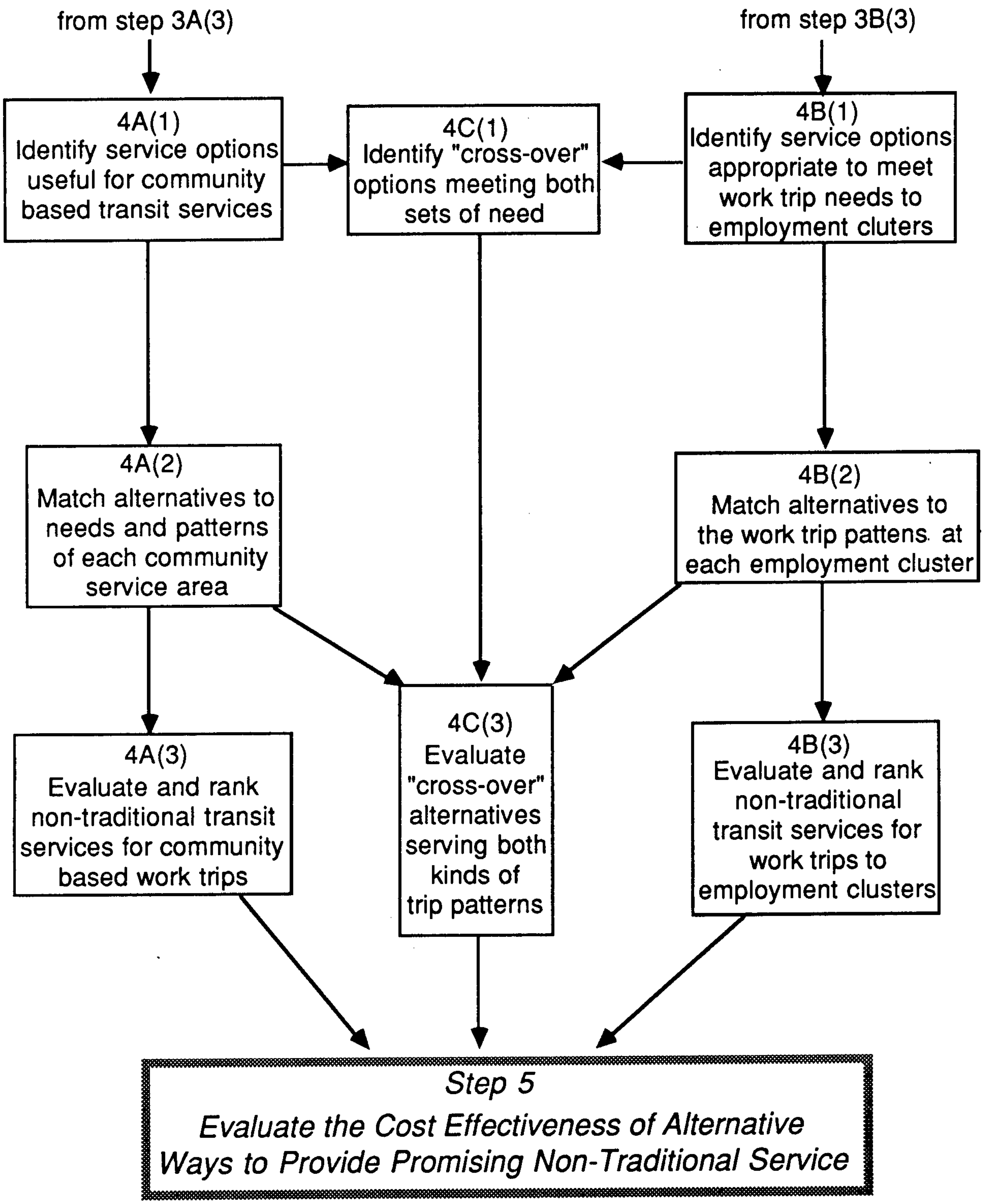
Residential Concentrations

In Task **4A** the transit operator focuses on the range of non-traditional **community based services** being implemented here and abroad, directly by the transit operator or under contract to the transit operator. These include community based flexibly routed services (generally, although not necessarily, using smaller, lower floor vehicles), taxis in their traditional service mode substituting for existing or requested fixed route services (all day or week-ends or late nights), and taxis and other shared rider providers operating either in a demand-responsive or flexibly routed mode.

Figure VI

Step 4

Evaluate Promising Non-Traditional Options in Meeting Suburban Work and Non-Work Trips



The approach analyzes how well these prototypes, or other local examples, or "hybrids" that seem logical given community travel patterns, meet the intensity, direction, and character of the non-work travel demand identified in Step 3. Further the approach gives highest priority to those service options that would work well in all or most community service areas, and those that could be coordinated with the major work trip concentrations (although not necessarily directly for those work trips).

In Task **4C** the operator also analyzes non-traditional options which could meet both work and non-work trips, although such options always seem more feasible in theory than they are in practice. Among the options to be considered are private van contractors or taxi operators who provide the home-to-work service and then become community-based transit providers during the middle of the day.

DATA NEEDED

All data needed for these analyses are provided by the three earlier steps; this is, essentially, an analysis task.

STEP FIVE - EVALUATE THE COST EFFECTIVENESS OF ALTERNATIVE WAYS TO PROVIDE PROMISING NON-TRADITIONAL SERVICES

The objective of this Step (Fig. VII) is to evaluate, a) the total costs and b) the unit costs of the non-traditional transit options found to be appropriate in Step 4 for the work and non-work trips identified in earlier steps. The purpose is to consider how these costs vary when delivered by different providers: transit operators directly, private operators directly (without subsidy), and private for- and not-for-profit operators under contract to the transit operator (ie receiving some public subsidy).

This approach stresses the fact that costs must be combined with some measure of the effectiveness of service delivery. Moreover, this approach emphasizes how the cost of the same service can change markedly if provided by different operators: under contract to a taxi or vanpool operator, for example, rather than directly provided by the transit system.

Figure VII shows the sequential and overlapping sub-tasks in Step 5. Both the work and non-work trip analyses end with a task that suggests the most promising and cost-effective set of alternatives.

STRATEGY

Employment Concentrations

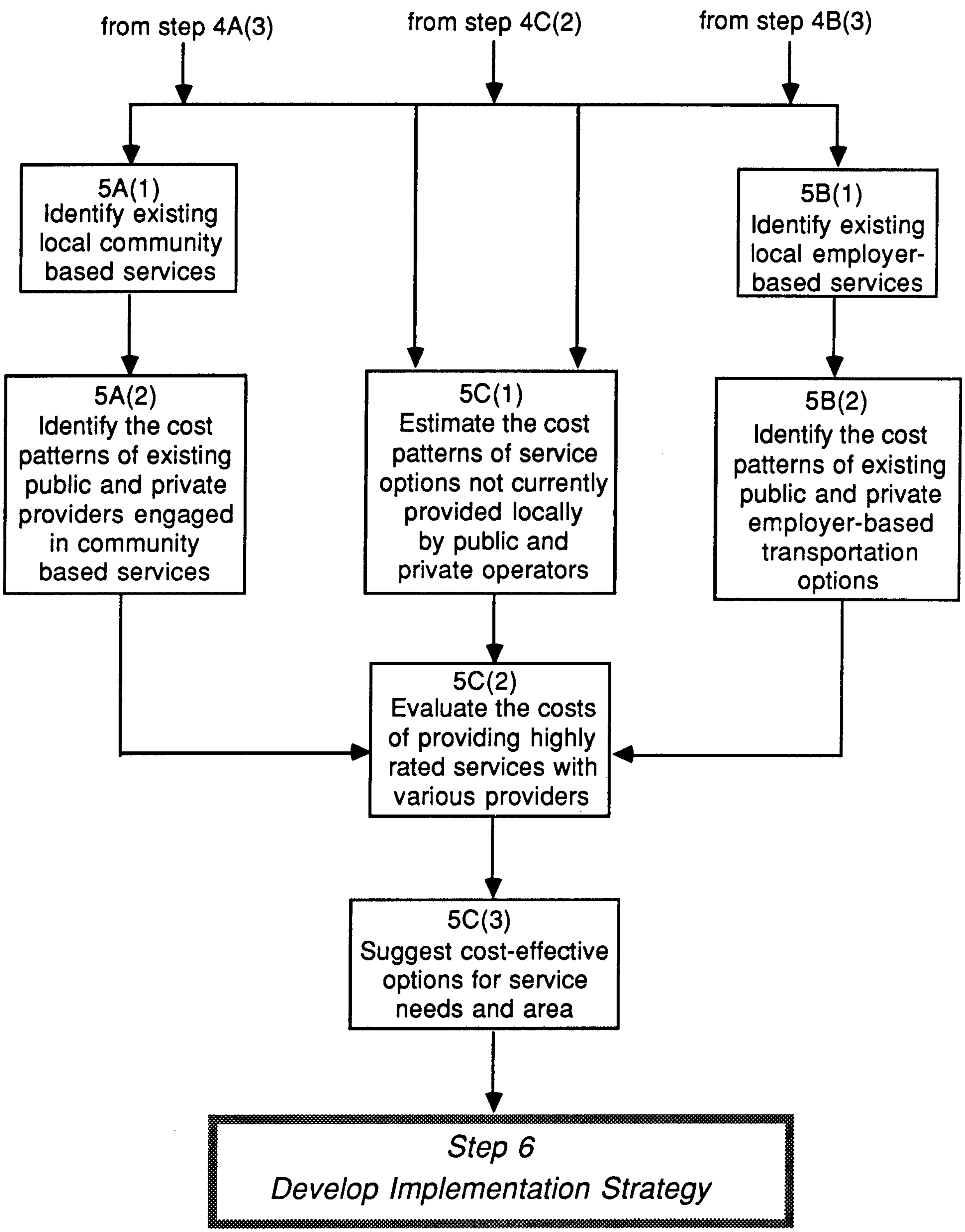
In Task **5B(1)** the transit operator identifies existing employer-based transportation services and evaluates their cost structure and performance. In Task **5C(1)** the operator identifies or estimates the cost and service performance of promising options which are not currently provided locally (using published studies, quotes from operators, etc).

Ultimately (**5C(2)**), the transit operator attempts to calculate what it would cost to provide the non-traditional options identified as promising in Step 4, based on the cost patterns of similar or comparable services. The purpose of this task is to clearly identify differences in costs for the same service by different providers as well as to compare the costs of providing different services.

Figure VII

Step 5

Evaluate the Cost-Effectiveness of Alternative Ways to Provide Promising Non-Traditional Services



Residential Concentrations

The analyses in task **5A** are generally more difficult than those undertaken for comparable work-trip based trips. Community based services can cover a range of options with a range of performance characteristics. The approach stress the fact that a very cheap service is not cost effective if it carries no passengers; a fairly expensive service may be cost effective if it carries few passengers--but at a lower price than previous or planned traditional transit services. For example, while fairly expensive, some communities have found it cheaper to pay full fare taxis to carry a few passengers than to continue to provide traditional fixed route service to those riders.

However the approach to developing cost and performance data is the same for both work and non-work trips. In **5A(1)** the transit analyst identifies the cost and service patterns of existing non-traditional service options. In **5C(1)**, the operator obtains cost and ridership information/projections on services not currently being offered in the community, by both analyzing studies on similar systems and by asking community providers what they would charge to provide the services under study.

As with work-based alternatives, in **(5C(2))**, the transit operator estimates what it would cost to provide the non-traditional options identified as promising in Step 4, based on the cost patterns of analogous services. The analyst's goal is to clarify differences in costs for the same service if delivered by **different providers** as well as to evaluate the costs of providing different services.

DATA NEEDED

Table Sixteen describes the data required to carry out Step 5; most data can be obtained from local operators and providers, or can be calculated from the data they provide. One of the most difficult parts of estimating costs is evaluating the number of riders to be carried, the length of time the service will be provided, and how providing different services in different areas will affect overall and unit service costs.

Many transit operators have cost models which incorporate their work rules, cost parameters, and resource allocations. These cost models may be sophisticated enough to give detailed financial information on the costs of providing different kinds of services over given areas for different riders. Many cost models, however, especially in smaller transit agencies, are very primitive; in such cases, system cost data can only give a vague idea of what it would cost to provide the kind of service identified as appropriate for low density suburban communities.

When local data, for either transit operators or private providers, are not available, or are not believable, they many be augmented with cost and ridership data from national studies, from nearby transit operators, and from other cities. The analyst will probably have to compute a **range** of potential cost figures in this case.

It is important to be very clear about the differences between average cost and marginal cost when pricing community based services. Asking a private operator to provide a limited service option in a small area may result in a very high initial cost; if a larger contract were considered the operator might be able to substantially lower contract charges [having more units (hours or riders or both) over which to spread overhead and vehicle costs].

Conversely, a transit operator may be able to provide small increments of additional service at very little cost; that is, the operator's marginal costs may be much lower than average costs for certain services or areas because of currently underutilized equipment or labor. The converse, may also be true; during peak periods, for example,

Table 16

Sources of Data Needed for Step 5

Sub Task	Data Sought/Needed	Local Sources/Local Data	National or Proxy Data
5A(2) and 5B(2) Identify cost patterns of existing public and private employer-based and community-based services	• Cost and service patterns of existing operators, differentiating average and marginal costs, known economies of scale, (if any), and response to varying fare levels	• Operators themselves (can be calculated from basic data provided by operators)	• National studies of similar services
5C(1) Estimate cost patterns of service options not currently provided locally	• Average and marginal cost patterns and economies of scale for potential alternatives	• Operators may be willing to suggest cost/prices • Can be estimated from basic data on existing services provided by operators	• National studies of similar services

most transit system resources are fully utilized and the marginal costs of service may be substantially higher than the average cost.

Ultimately, then, an analyst may find that the short and long-term cost patterns of different providers are very different; moreover costs may vary significantly with the volume of business, the time of day, and the length of service involved. It is quite possible that a promising alternative can be more effectively provided by a private contractor in one community and by the transit operator in another community.

STEP SIX - DEVELOP IMPLEMENTATION STRATEGY

The objective of this Step (Fig. VIII) is to develop a reasonable way to implement the cost-effective strategies identified in Step Five. This Step has two thrusts: the first attempts to identify and overcome legal or regulatory barriers to promising strategies, while the second develops a marketing program aimed at potential riders/users and other necessary participants (eg private companies on which vanpools are focused). Figure VIII shows the sequential and overlapping sub-tasks in Step 6 which are described below. All data required for analysis have been generated in previous steps.

The first focus begins by actually identifying formal and informal barriers to the operation of promising strategies. For example, under existing local taxi regulations, it might be illegal for operators to group trips to provide shared-ride services. It may even be illegal for company vanpools to operate without specific city or even state approval. These regulatory problems must be identified clearly and steps taken to change or overcome them.

Of course, some barriers, particularly for work-trip options which require significant employer participation, may face more ambiguous but just as difficult barriers. Transit operators must devise ways to secure the cooperation of the large firms and industrial parks since such cooperation is vital to the success of a number of options.

Table Seventeen suggests incentives that could or have facilitated the implementation of non-traditional alternatives or have increased ridership. These alternatives involve both carrot and stick approaches, and both short range and long range solutions. They range from restricting parking availability to encourage group-riding options to changing suburban zoning to allow greater land-use diversification (which would better support community based non-traditional options).

The second focus is a marketing approach, devising ways to inform and interest potential riders for both work and non-work options. These methods can range from fare-free or subsidized vanpool services for limited time periods to merchant tie-ins for community based services focused on commercial centers.

CONCLUSION

The six step methodology is designed to allow a transit operator to identify suburban areas or employment concentrations which potentially justify the provision of non-traditional transit options and then to consider the costs and effectiveness of promising local options, under different methods of service delivery with different providers. The methodology is designed to work with local data, augmented with national or proxy data, and to be easy to undertake and perform.

The methodology is applied to a large portion of a highly suburban and low density service area in Austin, Texas in the following section to both test and demonstrate the methods and approaches described here.

Figure VIII

Step 6

Develop Implementation Strategy

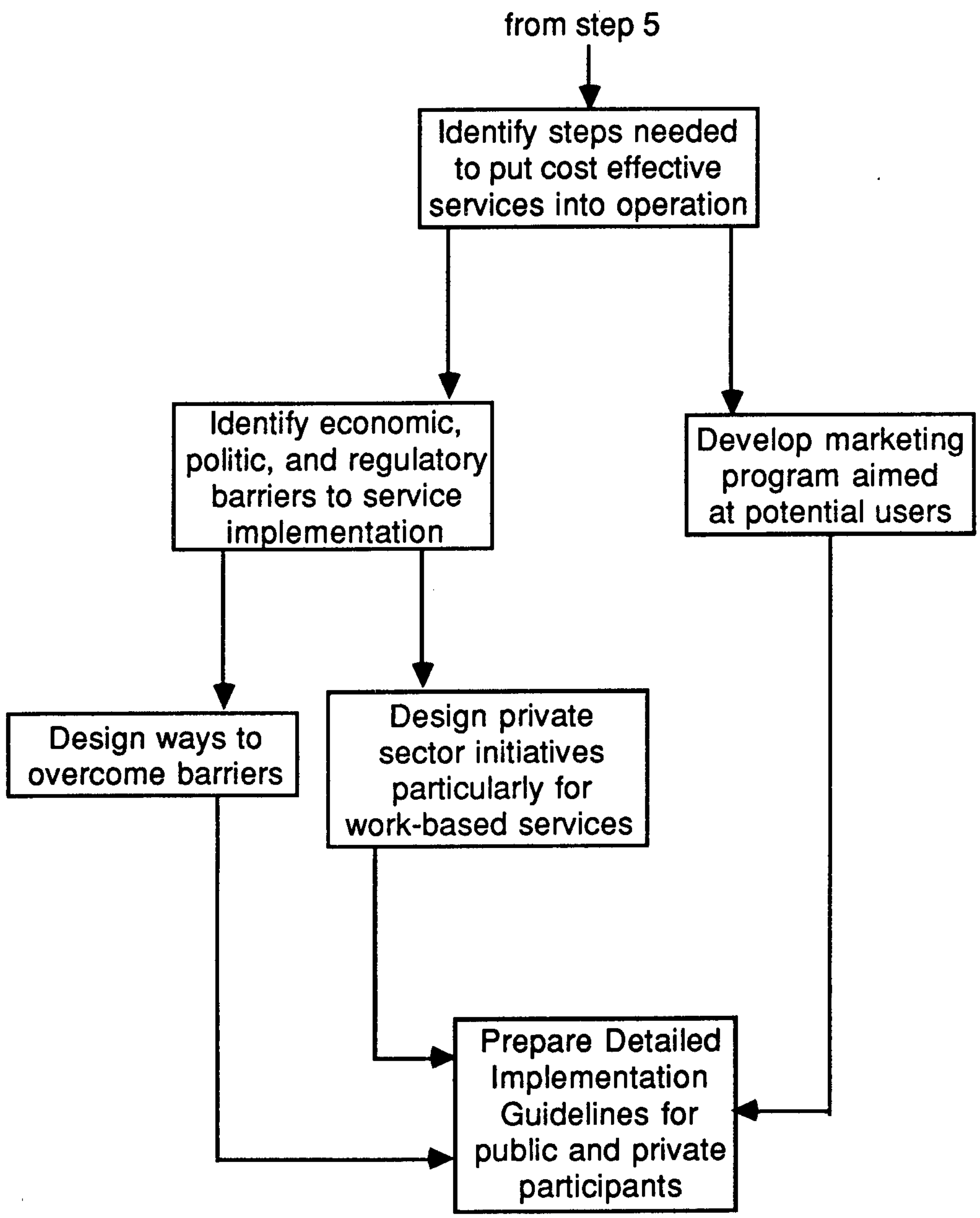


Table 17

MECHANISMS AVAILABLE TO FACILITATE PARATRANSIT RIDERSHIP

OPTIONS	POLICIES WHICH WOULD FACILITATE RIDERSHIP
WORK TRIPS	-Employer subsidies
Vanpool operation contracted with a private provider	-Preferential parking for vans
Vanpool operated by Capital Metro	-Restricted parking for auto users
	-Vanpool/carpool lanes on adjacent highways
	-Off peak transportation available
	-Promotion of mixed land used development
	-Encouragement of dense residential development
	-Encouragement of dense commercial development
	-Extensive marketing
NON-WORK TRIPS	-Introduction of timed transfer centers
Service area demand responsive with dedicated vehicles operated by a private contractor	-Subsidies from shop owners
	-Encouragement of dense residential construction
Service area demand responsive with dedicated vehicles operated by the transit authority	-Restricted parking
Service area demand responsive with shared vehicles (taxis) operated by a private contractor	-Promotion of mixed land use development
	-Extensive marketing and reduced fares

NOTES

1. Institute of Transportation Engineers, Using the ITE Trip Generation Report, prepared by Carl H. Buttke, Washington, DC: July 1984.

2. U.S. Department of Transportation, Personal Travel in the United States: 1983-1984 Nationwide Personal Transportation Study, Vol. II, Washington, DC: Office of the Secretary, Nov. 1986.

CASE STUDY APPLICATION

INTRODUCTION

This part of the study was designed to apply the methodology developed and described in the preceding section to the service issues facing a local transit operator, the Capital Area Metropolitan Transit Authority of Austin, Texas. The methodology was used to help Capital Metro expand the use of non-traditional transit services by 1) identifying which non-traditional options might be appropriate for different locations in Austin, 2) considering how appropriate non-traditional transportation options might be more widely implemented in the service area, and 3) investigating ways to incorporate planning for such options into the on-going Service Planning efforts.

Objectives and Summary Findings

Capital Metro was interested in focusing on one of its six corridors, or planning areas. The Study Team used the methodology to consider the type of non-traditional services which would work in the **US Highway 183 Corridor** and to develop, based on empirical data from the 183 Corridor, implementation guidelines which could later be applied throughout the service area.

Overall, using the methodology outlined in the previous Chapter, the Study Team found that 1) **vanpooling** for major employment concentrations and **demand-responsive services** in limited areas for non-work trips would be appropriate for the suburban development found in the Corridor, 2) appropriate non-traditional options would or do incur costs lower than Capital Metro's average cost/hour for fixed route bus service, and 3) several non-traditional alternatives could be implemented in the Corridor with total subsidies at or below those required by conventional transit services.

At least three of the major work sites--the Arboretum, Texas Instruments, and Northwest Techniplex--might be appropriate candidates for vanpooling types of non-traditional transit services. Additionally three sub-areas of the Corridor could each be served by a separate but comparable demand responsive service focused largely on non-work trips.

The following section describes the study approach; the sections that follow the first and second describe in detail how the method was applied, the data used, the assumptions made, and the financial undertaken.

Study Approach

The Study Team applied the method in the **U.S. Highway 183 Corridor**, one of six corridors into which the Capital Metro service area has been divided for study and service planning. The 183 Corridor itself was sub-divided into **five sections** for analyses and presentation; these sections are shown on Map One. As the Map details, four sections fall south of Leander with the East-West dividing line being U.S. Highway 183 and the North-South dividing line being Spicewood Springs/McNeil Road. The cities of Leander and Cedar Park comprise the fifth, and Northernmost, section of the Corridor *.

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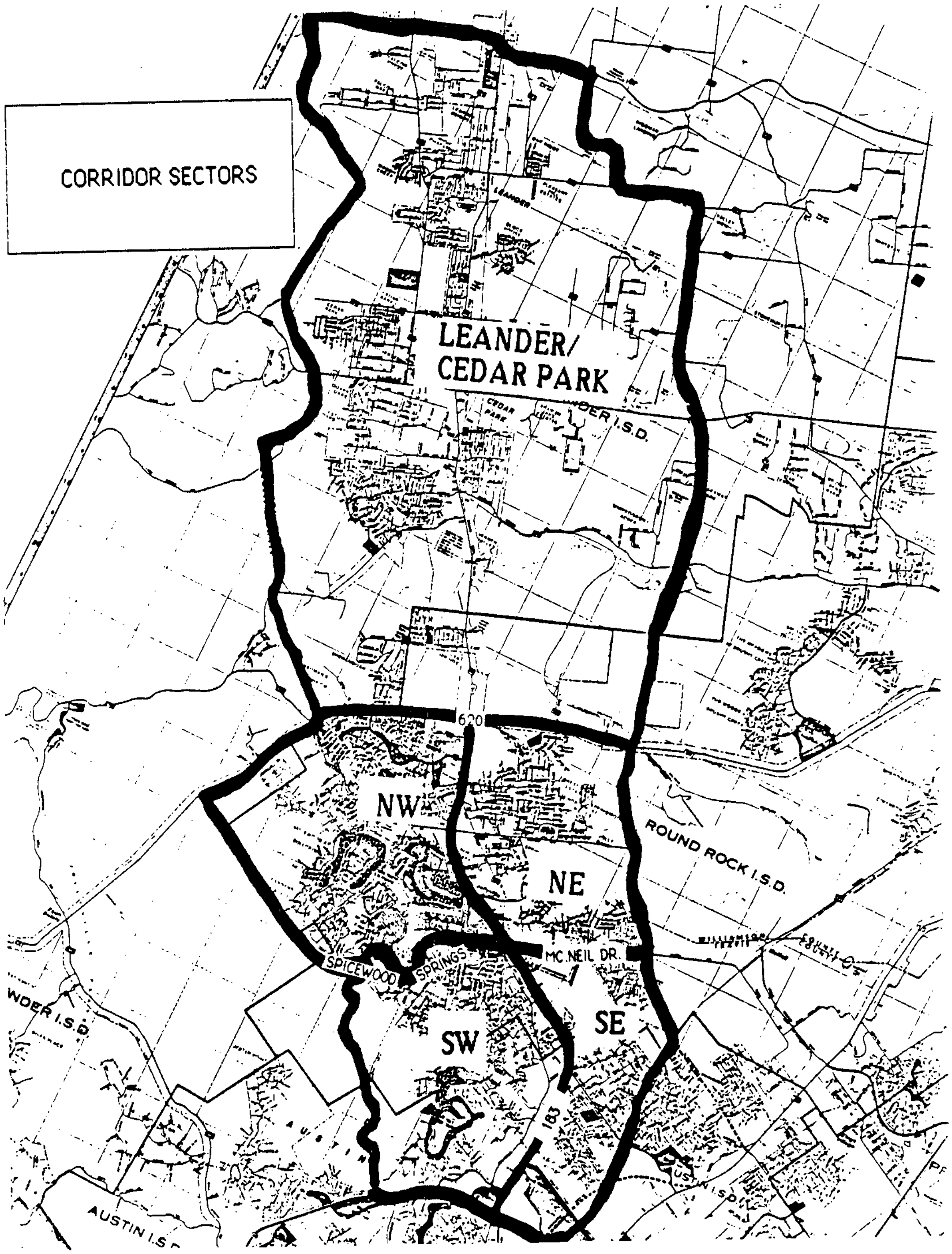
* All analyses were performed at the Traffic Serial Zone level and aggregated to the Section level. None of these five sections splits a Zone; some Sections do, however, occasionally split Census tracts or zip codes.

Map One


CORRIDOR SECTORS
LEANDER/
CEDAR PARK
620
NW
NE
ROUND ROCK I.S.D.
SPICEWOOD SPRINGS
MC.NEIL DR.
SE
SW
183
AUSTIN I.S.D.

The Study Team evaluated a range of existing and potential non-traditional alternatives including, a) taxi-based services and vanpools subsidized by Capital Metro but operated by another provider, b) demand-responsive services for the handicapped operated and subsidized by Capital Metro, as well as c) vanpools operated entirely by the private sector with no appreciable public subsidy.

In order to analyze travel patterns in the five areas of the Corridor and to evaluate alternative non-traditional options, the Study Team used population, employment, travel, and land use information on these five sections from a number of primary and secondary data sources (these are described in a special technical appendix to the report.

When essential data were not available, the Study Team was forced to rely on proxy or **default values.** In addition the analyses often had to make assumptions about the nature of traffic flows, service costs, or ridership parameters, etc.

To make this document accessible to the non-technical reader, as well as the professional planner, the text describes only the major assumptions and default data underlying each analysis. Specific technical details about the assumptions used in each analysis are available in the Technical Appendices, which contain: a) a comprehensive description of methods used to derive estimates etc., b) a complete listing of all proxy or default data used, and c) a description of the source, and conditions, of all default data.

Case Study Organization

The 183 Corridor study had four major phases; this report is organized to highlight each of these phases separately. **Phase One** analyzed socio-demographic characteristics, both city-wide and specifically in the Corridor, to identify the circumstances under which non-traditional or so-called "choice riders" might use carefully targeted non-traditional transit services.

Phase Two identified travel flows within the Corridor and between Corridors, distinguishing key work trip and non-work trip attractors in the Corridor--or concentrated activity sites on which non-traditional service options could be focused. **Phase Three** evaluated the cost and service characteristics of current Capital Metro non-traditional transit services as well as comparable or interesting services provided around the country.

Phase Four developed a series of implementation guidelines to match appropriate and productive non-traditional options with various work and non-work trip attractors. Such guidelines are designed to allow Capital Metro planning staff to evaluate the cost-effectiveness of various options in the 183 Corridor and throughout the service area.

The next major section of this report focuses on Phase One of the Study which analyzed the demographic and transportation characteristics of Corridor residents in an attempt to indicate potential riders for non-traditional services. A latter section discusses Phase Two, which identified major trip attractors and evaluated the implications of traffic flows throughout the Corridor on potential transit usage

SOCIO-DEMOGRAPHIC PROFILE - PHASE I

Phase One analyzed socio-demographic characteristics in the Corridor because of the significant relationship between transit use and certain population characteristics. Historically transit use has been highest among the lowest paid workers and those without cars--whether or not in the labor force. On the other hand, there is growing evidence that--**in certain narrowly defined situations**-- higher income people with easy access to cars will use transit.

The Study Team analyzed two issues: the socio-economic characteristics of Corridor residents, and, the known travel preferences of Corridor and Austin residents. The work was designed to identify:

a) pockets of traditional transit riders living in the Corridor, that is, **captive or transit dependent riders**--those who were poor, or carless, or with limited access to a household car;

b) non-traditional transit riders who might be induced to use certain non-traditional transit service for either work or non-work trips; and

c) captive but also non-traditional riders, such as children travelling alone and elderly drivers who occasionally wish to use transit services but will not sign up for special services.

Overall the analyses below show that, while there are few traditional captive riders in the 183 Corridor--far less than in the City as a whole--there are pockets of potential riders for carefully structured work and non-work transit services.

The following section first examines socio-economic information on those living in the five sections of the Corridor, then analyzes what is known about city-wide travel patterns and how those patterns might affect the 183 Corridor, and finally considers the transit planning implications of these findings.

Socio-Economic Information

The 183 Corridor is typical of many suburban places in Austin and the nation; with roughly 60 square miles and 60,000 people the average density is very low--under 1000 people per square mile. Most of those living in the Corridor have above average incomes, drive cars, and face relatively few disadvantages.

There are few people in the Corridor who fit the classic definition of traditional transit riders. Table Eighteen, which is based on published 1980 Census data, augmented by 1985 data from the City of Austin, shows that no more than 8% of the households in any part of the Corridor live below poverty level**; the highest concentration of those households are in the northernmost end of the Corridor (Leander and Cedar Park). While roughly 10% of the entire city of Austin is over 65 years of age, Corridor residents are much younger; only one section, that south of McNeil Road and east of Highway 183, has more than a 5% elderly population.

Table Eighteen also shows that few of either the elderly or children are poor, although both groups traditionally make up a significant percentage of those living below poverty level in most communities. Less than 1% of any of the elderly in the Corridor are below poverty level and two sections have no poverty-level elderly at all. No more than 4% of the children of any section of the Corridor are poor and the average for the Corridor is closer to 2%. The small concentrations of poor old and young people that do exist are again at the Leander/Cedar Park end of the Corridor.

Table Nineteen which is also based on published Census data augmented by 1985 City of Austin data, shows that few people in the Corridor lack adequate transportation resources

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** In 1980 the income cut-off for poverty-level for non-farm families of four people was $8,414.

Table 18
SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE 183 CORRIDOR

CORRIDOR SECTION	1985 ESTIMATED POPULATION	PERCENT OF PEOPLE BELOW POVERTY	PERCENT OF POPULATION OVER 65	PERCENT OF ELDERLY PEOPLE BELOW POVERTY	PERCENT OF CHILDREN IN POVERTY
Southwest	12,115	3.00	2.00	0.12	1.30
Northwest	16,527	5.80	3.00	0.70	2.80
Southeast	7,845	3.60	8.00	0.00	2.10
Northeast	10,661	3.80	3.00	0.00	1.70
Leander/ Cedar Park	10,853	7.80	5.00	1.20	3.40

Note: The corridor sections are not completely co-terminus with census tract boundaries so some estimation was neccessary; a conversion table appears in the Technical Appendix.

Key: The North-South dividing line for the sections is Mc.Neil Rd./Spicewoods Springs Rd.

Source: Derived from U.S. Census, Vol. 45, 1980, Tables H-7, P-9, P-10 & P-11 and tape readable Socio-Economic data by traffic serial zone provided by Capital Metro.

Table 19

CORRIDOR HOUSEHOLD CHARACTERISTICS RELEVANT TO TRANSIT PLANNING

CORIDOR SECTION	PERCENT OF TOTAL POPULATION WITH TRANSIT DISABILITY	PERCENT OF ELDERLY POPULATION WITH TRANSIT DISABILITY	PERCENT OF HOUSEHOLDS WITH NO CARS	PERCENT OF TWO WORKER FAMILIES	PERCENT OF HOUSEHOLDS WITH ONE CAR	PERCENT OF FAMILIES HEADED BY A WOMAN
Southwest	0.24	0.56	0.43	63.50	17.90	7.00
Northwest	0.33	0.67	0.64	58.20	9.40	5.20
Southeast	0.31	0.20	0.00	58.60	9.40	6.60
Northeast	0.11	1.05	1.20	60.90	17.20	4.50
Leander / Cedar Park	0.62	0.48	2.30	51.60	15.20	5.70

Key: The North-South dividing line for the sections is Mc.Neil Rd./Spicewoods Springs Rd.

Source: Derived from U.S. Census, Vol. 45, 1980, Tables H-7, P-9, P-10 & P-11.

or face transportation problems. Under 1% of the total population report a transit disability; the percentage of elderly reporting transit disabilities is often double that of the total population--and still under 1%!. Roughly 5% of families in the Corridor are headed by females (far less than the Austin average) but roughly 17% of such women in the entire city of Austin do not own a car; comparable figures are not available for the Corridor.

Overall there are barely any households in the Corridor that do not have at least one car. In fact, most Corridor residents have access to more than one car; Census data show that almost three-fourths of all households have two or more cars. In fact roughly **one-third** of all households have three or more cars! Car ownership rates are explained in part by the number of two worker households; over half of all families in the Corridor have two adult workers and another 9-15% have three or more workers.

Obviously, while there may be small pockets of "captive" transit riders in the area, particularly in Leander and Cedar Park, the potential market for non-traditional services is among those who can chose to drive, or be driven, but who will use transit if it meets higher and very specific performance criteria.

The following section focuses in greater detail on the transportation patterns of Austin residents. This analysis suggests the circumstances under which non-traditional people have been willing to use non-traditional transit options in Austin.

AUSTIN TRANSPORTATION PATTERNS - PHASE II

Introduction

This section focuses on the home-to-work travel patterns of Austin residents with an emphasis on who uses public transit or paratransit and under which circumstances. This information may indicate the willingness of non-captive travellers to use transit or non-traditional options like vanpools.

The analyses presented below show that, while the use of transit is heaviest among lower income groups, there is some small use by fairly high income individuals. The analyses also show that more women than men carpool to work but that larger carpools are dominated by higher income, generally male, travellers! Both circumstances suggest that there is indeed a market for carefully designed non-traditional options in the 183 Corridor and similar areas in Austin.

Traditional Transit Usage

Austin transit users exemplify ridership patterns found throughout the country; in general transit ridership is negatively correlated with income. In 1980 Austinites were less likely to use transit to work as their household income went up; Table Twenty shows that less than 11% of any income group used the bus to go to work.

As transit ridership went down car use usually went up, although at very low incomes (under $10,000) and very high incomes (over $40,000) walking, cycling, and working at home were significant work trip modes. These Census findings, showing an inverse relationship between transit use and income, are consistent with the Capital Metro On-Board study which found that almost 50% of all bus riders had household incomes under $15,000.

However there are patterns in Austin's transit ridership that have implications for predicting non-traditional ridership in the 183 Corridor. Table Twenty-One, which

Table 20
Mode to Work by Household Income, Austin, 1980

Household Income	Car*	Public Transit	Other**
Under 5,000	73.5	10.8	15.7
5,000 - 9,999	83.2	4.8	12.0
10,000 - 14,999	89.4	4.3	6.4
15,000 - 19,999	94.2	2.1	3.8
20,000 - 24,999	94.7	1.6	3.7
25,000 - 29,999	94.7	0.5	4.8
30,000 - 34,999	97.4	1.7	0.9
35,000 - 39,999	95.4	-	4.6
More than 40,000	91.0	0.6	8.4

* "Car" includes drivers & passengers

** "Other" includes walking, cycling, and working-at-home

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

Table 21

1980 Transit Users to Work by Sex and Household Income, Austin

Household Income	Male	Female
Under $5,000	18.8	22.2
5,000 - 9,999	18.8	29.6
10,000 - 14,999	31.3	18.5
15,000 - 19,999	6.3	14.8
20,000 - 24,999	12.5	7.4
25,000 - 29,999	6.3	-
30,000 - 34,999	6.3	3.7
35,000 - 39,999	-	-
More than 40,000	-	3.7
Total	100.0*	100.0*

* Does not actually add to 100 beause of rounding errors

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

disaggregates transit users by sex as well as household income, shows that more female riders had low income than male riders; that is, higher income men were more willing to use transit than comparable female workers. Over half of all female transit riders had incomes under $10,000 and almost all female transit riders had incomes below $20,0000. However almost one-fourth of all male riders had incomes above $20,000.

In short, while all women are more likely to use transit for the home to work trip (10% compared to 8% for men), higher income men are more likely to use transit than comparable women. This may reflect differences in the location of men and women's traditional employment opportunities in Austin; there may be greater spatial concentrations of low income jobs for women, on one hand, and of higher income jobs for men, on the other. Such employment concentrations are an encouragement to transit use in suburban areas.

Carpool Use Patterns

There are similar patterns in carpool use data; while few people do carpool, overall women are more likely to do so than men, and, higher income men are more likely to do so than comparable women. Table Twenty-Two shows the first pattern clearly: of the 90+% of travellers going to work by car, over 70% are driving alone at all income levels. Table Twenty-Three also illustrates this pattern: differences, as with transit, may be sex related. Among those who use a car to travel to work, greater percentages of women are carpool members than men.

Table Twenty-Two also shows, perhaps surprisingly, that carpool usage seems to go up as income increases, being highest at incomes in the mid $30,000 and only dropping off at incomes above $40,000. In fact those making between $30 and 40,000 are more likely to carpool than those making between $5 and 15,000!

Table Twenty-Four also illustrates the second major carpool usage pattern; high income men are more likely to be in a carpool than comparable women. Over 53% of all women who are carpool members have incomes below $20,000 while almost 70% of all male carpool members have incomes above $20,000. At every income level above $20,000 men are more likely to be in a carpool than women with comparable household incomes.

Table Twenty-Five shows a surprising trend; in general the size of the carpool goes up as household income goes up. The overwhelming number of two person carpools are made up of people with incomes below $25,000 while over 70% of four person carpools are made up of those with incomes above $25,000.

Of course, most carpools have only two members and the overwhelming majority are composed of spouses driving to work together; in short, most two member carpools are not "choice" carpools and the two workers may not be employed near one another. (The Capital Metro marketing study found that 81% of all Austin carpools were composed of people related to one another or living together.) But it seems safe to assume that the larger carpools, while only a small percentage of all carpools, are, indeed, composed of non family members or "choice" riders, who probably do work near one another.

Implications

These two sets of analyses show that there is a small group of higher income individuals who use transit or join non-family carpools. First, the basic demographic data suggest that there are a small number of non-traditional riders, such as children and the elderly as well as those in one-car households, who might use a customized non-work transit service. Second, the PUMS Census data suggest that higher income individuals in Austin can be induced to use vanpool type transit services similar to carpools if these services

Table 22

1980 Type of Auto Use To Work by Household Income, Austin

Household Income	Driving Alone	Carpool Member
Under 5,000	80.3	19.7
5,000 - 9,999	78.7	21.3
10,000 - 14,999	72.4	27.6
15,000 - 19,999	72.2	27.8
20,000 - 24,999	77.7	22.3
25,000 - 29,999	80.3	19.7
30,000 - 34,999	70.8	29.2
35,000 - 39,999	73.2	26.8
More than 40,000	84.1	15.9

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

Table 23

1980 Type of Auto Use To Work by Sex of Respondent, Austin

Sex	Driving Alone	Carpool Member
Male	79.3	20.7
Female	72.7	27.3

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

Table 24

Likelihood of Being in Carpool to Work by Sex and Household Income

Household Income	% Carpool Members Males	 Females
Under $5,000	5.9	1.2
5,000 - 9,999	8.2	15.5
10,000 - 14,999	18.7	15.5
15,000 - 19,999	15.8	21.4
20,000 - 24,999	15.8	14.9
25,000 - 29,999	11.7	8.9
30,000 - 34,999	9.9	9.5
35,000 - 39,999	5.9	7.1
More than 40,000	8.2	6.0
Total	100.0	100.0

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

Table 25

Percentage of Each Carpool Size Accounted for by Household Income Groups, Austin 1980

Household Income	Number of People in Carpool		
	Two	Three	Four
Under $5,000	4.5	1.8	0.0
5,000 - 9,999	13.6	7.1	3.9
10,000 - 14,999	18.9	16.1	7.7
15,000 - 19,999	15.6	33.9	11.5
20,000 - 24,999	15.2	8.9	26.9
25,000 - 29,999	9.1	8.9	30.8
30,000 - 34,999	9.1	8.9	15.4
35,000 - 39,999	6.6	5.4	3.8
More than 40,000	7.4	8.9	0.0
Total	100%	100%	100%

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

meet their specific worktrip needs.

TRANSPORTATION FLOWS IN THE 183 CORRIDOR - PHASE III

The goal of Phase Two was to identify the work and non-work trip patterns within the Corridor which might be matched to promising non-traditional transit options. To do so, the analyses identified: 1) flows between the 183 Corridor and other parts of Austin by type of trip, 2) flows within the Corridor by type of trip, 3) major work-trip and non-work trips attractors within the Corridor, and 4) the number of trips attracted daily to those work and non-work sites.

The Team identified five major employment concentrations and five major shopping/personal business concentrations and then considered which non-traditional options could be matched to the daily trips attracted to those land use patterns, giving weight to the demographic analyses conducted in Phase One.

The kind and location of both employment centers and employees suggested that vanpool options would be most appropriate for non-traditional **work oriented trips.** The kind of non-work concentrations and the demographic make-up of the Corridor suggested that demand-responsive options would most appropriate for **discretionary (ie non-work)** trips.

Phase Two analyses show that three of the major work sites--the Arboretum, Texas Instruments, and Northwest Techniplex--might be appropriate candidates for vanpooling types of non-traditional transit services. The analyses also show that three sub-areas of the Corridor could each be served by a separate but comparable demand responsive service focused largely on non-work trips.

Inter-corridor flows

Most Corridor residents do not work within the Corridor but, like most modern suburban workers, they also do not work in the traditional core of the city. Table Twenty-Six shows inter- and intra-Corridor flows by trip purpose as derived from the 1988 Marketing Baseline Study conducted for Capital Metro by Nustats, Inc.; roughly **11%** of work trips generated by residents within the Corridor stay in the Corridor while the overwhelming majority--77%--work in other non-downtown areas of the City.

Non-work trips for shopping, medical, socializing, and personal business are much more likely to stay within the Corridor; roughly **75%** of those trips are destined for facilities within the 17 mile long Corridor.

The percentages of trips found to stay within the Corridor for work and non-work trips, **11%** and **70%** respectively, were used in subsequent analyses as default values where more site specific information was not available.

Trip attractors and generators

In the second part of Phase Two the Study Team identified five major work trip and five non-work trip attractors in the Corridor and calculated the trips **from within the Corridor** attracted to, or near, each of these major attractors. The Team then considered how many of these trips were likely candidates for the non-traditional transit options suggested by Phase One: vanpooling and community demand responsive services.

Table 26

DISTRIBUTION OF TRIPS TO AND FROM THE 183 CORRIDOR

	WORK	SCHOOL	DISCRETIONARY
Percent of all trips in Austin which originate in the 183 corridor	14%	14%	13%
Trips originating in the corridor			
Staying in the corridor	11%	3%	75%
Going to other corridors	77%	55%	20%
Going to Core	12%	42%	5%
Trips originating in other corridors			
Coming to 183 corridor	2%	2%	2%
Going to other corridors	85%	92%	93%
Going to Core	13%	6%	5%

Source: Derived from the Report on Marketing Baseline Study conducted for Capital Metro, Nustats, Inc., 1988.

Major Employment Sites

Most of the commercial and industrial development in the Corridor occurred in the southern portion, below Highway 620. Moreover the majority of those sites were "strip developments," on or adjacent to Highway 183. Residential development however, while also heavier in the southern end, was distributed all through the land area of the Corridor.

The Corridor has five major employers or employment concentrations, all in the southern portion below Highway 620, as shown on Map Two: The Arboretum Office Complex, a small 3M facility, The Stratum office complex near Balcones Woods, the large Texas Instruments site near the middle of the Corridor, and N.W. Techniplex, adjacent to Texas Instruments.

Table Twenty-Seven shows that approximately 1,000 of the 7,500 employees at these five sites live in the Corridor. However additional analysis shows that a significant percentage of those workers lived too close to their employment site to be good candidates for vanpooling or any other non-traditional transit services in the absence of sanctions against driving alone or parking at the job.

Data from other cities clearly indicate the relationship between distance from work and the use of company oriented vanpools; at the 3M facility in St. Paul, often heralded for its encouragement of transit and paratransit modes, approximately 13% of the total workforce comes to work in a vanpool but only 15% of all vanpoolers live less than ten miles from the job. VPSI, the national private firm which operates vanpools in Austin (see the following section), will not consider organizing such services less than 15 miles from the employment site, unless it receives a subsidy.

Tables Twenty-Eight and Twenty-Nine illustrate two ways in which the Study Team estimated the number of potential vanpoolers among the employees at each of the five major work sites. Table Twenty-Eight estimates a **high** and a **moderate** percentage of <u>all</u> employees who live in the Corridor who might vanpool or rideshare. The percentages used were based in part on 3M's experience and in part on the experiences of other cities reported on in the literature.

Table Twenty-Nine, with the smaller estimates, is perhaps the more realistic assessment; it also estimates a high and low percentage, but only of those employees <u>living over ten miles away</u> from each of the five work sites. In general, all of the employees shown in this Table live in the northernmost end of the Corridor in Leander and Cedar Park, although some potential riders among Arboretum employees live slightly south of those cities.

It is clear that the moderate numbers of workers at each site would hardly support a vanpool effort. However, given active company encouragement and perhaps sufficient financial incentives, at least three of the major work sites--the Arboretum, Texas Instruments, and Northwest Techniplex--might be appropriate candidates for vanpooling types of non-traditional transit services.

Non Work Trip Attractors

There are seven major grocery stores located in five major shopping centers in the Corridor; they are shown on Map Three. Although there is substantial commercial development all along U.S. Highway 183, most of the shopping and routine commercial

Map Two

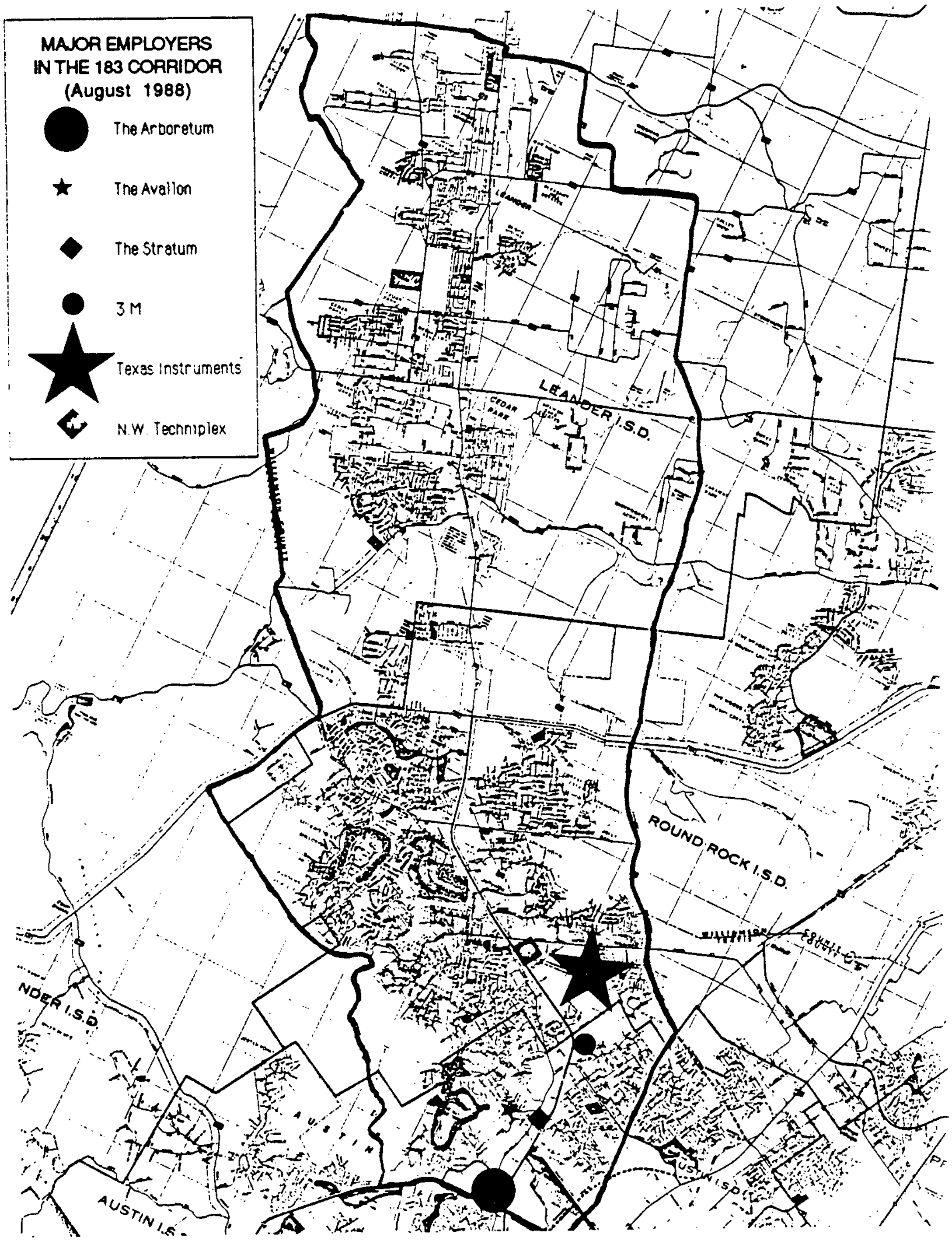

MAJOR EMPLOYERS
IN THE 183 CORRIDOR
(August 1988)
The Arboretum
The Avallon
The Stratum
3 M
Texas Instruments
N.W. Technıplex
LEANDER I.S.D.
ROUND ROCK I.S.D.
AUSTIN I.S.D.

Table 27

TRIPS ATTRACTED TO THE MAJOR EMPLOYERS IN THE 183 CORRIDOR

COMPLEX	TYPE	AREA (Sq. Feet)	ACTUAL OR *CALCULATED EMPLOYMENT	COMPUTED AM PEAK IN-CORRIDOR ATTRACTIONS (Person Trips)
Arboretum 1	Office Building	250,000	608 *	39
Arboretum 2	Office Building	550,000	1,338 *	85
Arboretum Point	Office Building	148,000	360 *	24
Great Hills	Office Building	167,706	408 *	27
Health Care International	Office Building		200	18
Total "Arboretum Office Complex"	Office Building		2,914 *	192
3M	Light Industrial		300	84
The Stratum	Office Building	240,000	584 *	37
Texas Instruments	Light Manufacturing		2,400	669
N.W. Techniplex	Office Building	550,000	1,338 *	85

Sources: Derived from information provided in the ITE Trip Generation Report; National Personal Transportation Study, 1983; Report on Marketing Baseline Study for Capital Metro (Nustat Inc, Feb. 1988); Telephone conversations with the Human Resources Department of 3M; Sector 14 and Sector 15 Background Information (Planning and Growth Management, 1987); and a listing of places of residence of Texas Instruments employees by Zip Code.

Table 28

POTENTIAL RIDE-SHARING NON-TRADITIONAL OPTIONS RIDERSHIP FOR THE WORK TRIP

COMPLEX	COMPUTED A.M. PEAK IN-CORRIDOR WORK-TRIP ATTRACTIONS	POTENTIAL RIDE-SHARING NON-TRADITIONAL OPTIONS RIDERSHIP (number of vanpool subscribers)	
		HIGH 13%	MODERATE 3%
Arboretum Office Complex	192	26	6
3M	84	11	3
The Stratum	37	5	1
Texas Instruments	669	89	20
Northwest Techniplex	85	11	3

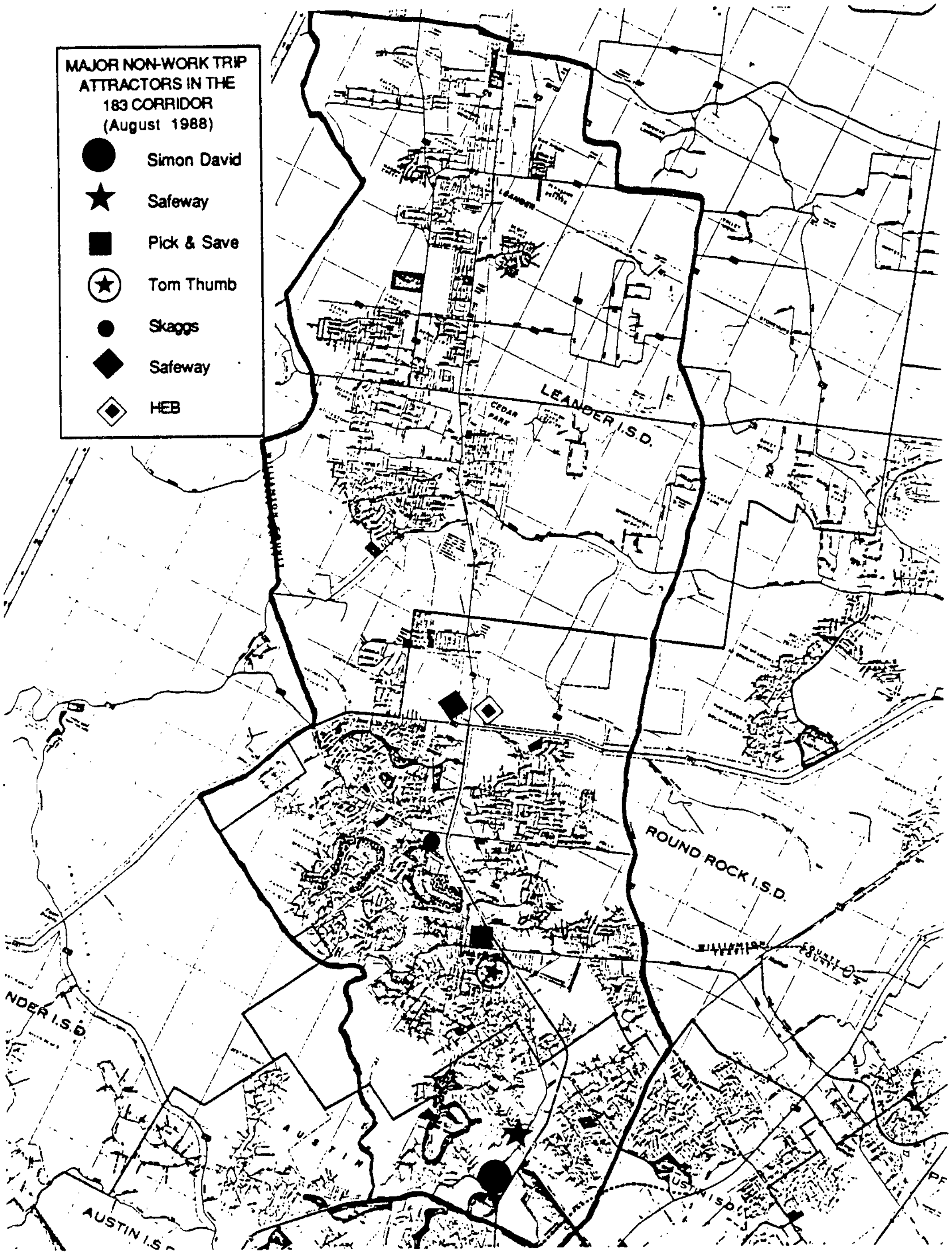
Table 29

POTENTIAL RIDE-SHARING NON-TRADITIONAL OPTIONS RIDERSHIP FOR THE WORK TRIP FOR TRAVEL DISTANCES OVER TEN MILES

COMPLEX	COMPUTED A.M. PEAK IN-CORRIDOR WORK-TRIP ATTRACTIONS FOR TRAVEL DISTANCES OVER 10 MILES	POTENTIAL RIDE-SHARING NON-TRADITIONAL OPTIONS RIDERSHIP (number of vanpool subscribers)	
		HIGH 13%	MODERATE 3%
Arboretum Office Complex	147	20	4
3M	25	3	1
The Stratum	29	4	1
Texas Instruments	180	24	5
Northwest Techniplex	65	9	2

Sources: See Table Eleven and Technical Appendix.

Map Three


MAJOR NON-WORK TRIP ATTRACTORS IN THE 183 CORRIDOR (August 1988)
Simon David
Safeway
Pick & Save
Tom Thumb
Skaggs
Safeway
HEB
LEANDER I.S.D.
ROUND ROCK I.S.D.
AUSTIN I.S.D.

sites appear to be located in the shopping centers which these grocery stores "anchor" *. Two major medical facilities in the Corridor are near Balcones Woods in the southern end of the Corridor.

Table Thirty shows that four of the five shopping centers attract a significant number of daily trips from inside the Corridor. The Simon David store near the Arboretum, which is located at the very southernmost border of the Corridor, largely serves the residents of other Corridors.

Phase One findings, based on 1980 Census data, suggested that there are a small number of potential riders for a non-work demand responsive service. Phase Two analyses show that there is an appreciable market for such services under even conservative estimates of potential ridership.

Table Thirty-One shows that even if only 1% of all shopping, personal business, and other non-work trips were to be made using non-traditional service, there would be roughly 500 potential trips per day. (NPTS data show that roughly 1% of all non-work trips in the U.S. are made using conventional transit; the Capital Metro Baseline study shows a comparable figure for Austin.) If the superior nature of the service were to induce greatest ridership, as many as 1,500 trips per day would use a demand responsive service.

The location of these shopping centers, and the magnitude and nature of the travel they attract, suggest that there are three sub-areas of the Corridor which could each be served by a separate but comparable demand responsive service focused largely on non-work trips. There are three reasons for dividing the entire Corridor into three community service sections.

First, as Table Thirty-One shows, there is sufficient ridership to support three separate community based services, even under conservative ridership estimates. Second, NPTS data show that people do most (almost 2/3) of their shopping and the majority of their other personal business (50-80%) within five miles of their home so most of their needs would be taken care of in one community service area.

Third, the Corridor is too large to be efficiently served by only one system--doing so would sharply reduce the level of service delivered to passengers and would drastically reduce ridership. To address any problems created by restricting service to a one specific area, each service area could overlap slightly so that 90% of all the potential non-work destinations of an individual household would be served by one community demand responsive service. Additionally a special but much higher fare could be set for out-of-area trips.

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* A complete list of **all** commercial and shopping sites in the corridor appears in the Appendix which also contains a list of all stores at each of the five centers.

Table 30

DAILY PERSON TRIPS TO MAJOR NON-WORK ATTRACTORS

SHOPPING CENTER COMPLEX; ANCHOR STORE(S)	COMPUTED DAILY IN-CORRIDOR PERSON-TRIPS		
	SHOPPING	FAMILY AND PERSONAL BUSINESS	TOTAL
Simon David	154	83	237
Safeway	2,188	1,179	3,367
Pick N'Save and Tom Thumb	2,222	1,198	3,420
Skaggs	2,944	1,587	4,531
Safeway and HEB	3,047	1,642	4,689

Source: See Technical Appendix

Table 31

NON-WORK TRIPS IN THREE POTENTIAL TRANSIT SERVICE AREAS

SERVICE AREA SECTIONS	COMPUTED DAILY IN-CORRIDOR NON-WORK TRIPS				POTENTIAL TRANSIT RIDERSHIP	
	SHOPPING	MEDICAL	FAMILY AND PERSONAL BUSINESS	ALL OTHER NON-WORK TRIPS	HIGH (3%)	AVERAGE (1%)
South Southwest Southeast	6,729	837	5,134	5,564	548	183
North Northwest Northeast	7,027	781	4,835	5,564	546	182
Leander/ Cedar Park	2,994	476	2,128	5,564	335	112

Source: See Technical Appendix.

Implications

Because there are concentrated sites of both employment and commercial activity within the Corridor, there are definite opportunities for some kinds of non-traditional transit services. These range from employer based or sponsored vanpools serving the large employment sites to community based demand responsive services serving heavily developed portions of the Corridor.

The next section considers 1) what it would cost to provide these services which seem initially appropriate and 2) how Capital Metro can evaluate the cost-effectiveness of comparable services in other portions of the City.

COST AND SERVICE CHARACTERISTICS - PHASE III

The goal of Phase Three was to identify the cost and service patterns of the most promising non-traditional transit options, to identify potential ridership and ultimately productivity for such options, and to consider their cost effectiveness. To do so, the Study Team 1) analyzed the cost and service patterns of the non-traditional services already underway in Austin, 2) compiled cost and service data on similar systems throughout the country, and 3) suggested the likely cost and productivity ranges that Capital Metro would face in implementing promising options in the 183 Corridor or elsewhere in Austin.

The Study considered as "non-traditional" services those that differ from fixed route services in either the **way** services are delivered, **who** actually delivers them, or **how** a public subsidy is administered.

Because Phase One and Phase Two suggested definite types of non-traditional services which would be most appropriate for the Corridor--vanpools and community-based demand responsive services--this Phase focused on different ways to provide these services. The Study Team analyzed options ranging from totally private delivery and financing of vanpooling (much the way the VPSI vans in Austin now operate) to the taxi operator providing demand-responsive services to the general public (much the way the current Elderly and Handicapped services are delivered in Austin).

Austin's Non-Traditional Services

Capital Metro has been diversifying the type of transit services it provides and it has been increasing the proportion of services contracted with private companies. Capital Metro currently provides or authorizes demand responsive service to the elderly and handicapped, feeder service to express buses, vans substituting for fixed route buses in low density areas or on weekends or evenings, and vanpools for the commuter trip.

All of Capital Metro's current non-traditional options are shown in Table Thirty-Two; the Table makes clear that almost all of these options involve private providers in major service roles. The Table also shows that cost figures for different providers a) range widely from a high of almost $35/hour to a low near $20/hour and b) that all cost figures are not easily comparable because Capital Metro pays differently for different services.

Table 32

NON TRADITIONAL TRANSIT OPTIONS OPERATED OR CONTRACTED BY CAPITAL METRO (CMTA)

TYPE OF SERVICE	PROVIDER	VEHICLES	COST TO CMTA	RIDERSHIP
GENERAL PUBLIC				
FIXED ROUTE				
Off-Peak and Saturday fixed suburban route	American Cab	14 pass. vans	$34.93 / hour	5 riders / trip
Saturday fixed suburban route	American Cab	14 pass. vans	$34.93 / hour	6 riders / trip
Express (4 trips per day)	American Cab	14 pass. vans	$34.93 / hour	80 riders / week
OTHER				
Vanpools (from nearby towns to the CBD)	VPSI	14 pass. vans	$0.14 / pass. or $972 / month*	13 riders / trip
Demand responsive from the Northwest area to the central city	CARTS	Vans	$21 / hour	23 pass. trips / week
Feeder Service from Northwest communities to an express bus service to the central city	CARTS	Vans	$21 / hour	191 pass.trips / week
ELDERLY & HANDICAPPED				
Special Transit Services for the ambulatory elderly and the handicapped	American Cab	Taxis	$6.95 / pass.** $8.47 / pass.***	2,140 riders / week
Special Transit Services for the elderly and the handicapped	CMTA	Special vehicles	$47.32 / hour	3,939 riders / week

* Capital Metro acts as the project manager, in charge of marketing, management and facilitating contacts. The cost shown is the CMTA administrative cost allocated to this service.

** Amount paid to the taxi company (December 1987).

*** Total cost which includes the amount paid to the taxi company and the internal administrative cost (December 1987).

Sources: Capital Metro cost model for December 1987, conversations with CMTA officials, CMTA route maps, and Capital Metro's 1988 Boarding and Alighting Survey.

An examination of the actual operating experiences of these non-traditional services reveals that more expensive ones are also the more experimental and small-scale; given either longer experience or larger passengers volumes it is likely that the cost of these services will fall so they are a) comparable with other city non-traditional services and thus fairly cost effective and b) comparable to costs found in other cities (discussed below).

All of the costs figures shown in Table Thirty-Two are far lower than Capital Metro's estimated marginal cost for fixed route bus service--$42.32/revenue hour or for van service--$45.57 [1]. Overall most of the non-traditional services which Capital Metro provides are relatively more cost effective than traditional services because of the great differential between the contract costs and the Authority's cost per vehicle hour of service for new services.

The sections below describe each current Capital Metro service in greater depth.

Commuter Vanpool Service

There are two major types of vanpool service provided under Capital Metro auspices. The first type of vanpool service is provided entirely by a private operator without any direct public subsidy; Capital Metro participation is limited to marketing, matching potential poolers, and facilitating contracts between riders and the company.

VPSI, the operator, is a subsidiary of Chrysler, which operates commuter vanpools around the country. VPSI leases the vans to the users for approximately $560/month plus 7c/commute mile. The driver of the van is also a commuter; s/he does not pay for the service and is able to use the van for private use when not in commuter service. The driver however has to collect the fares from the other riders and to complete any required paperwork.

Currently each 15-person capacity van averages 13 daily riders; in December of 1987 slightly over 7,000 passenger trips were carried by the vanpool system at an average fare of roughly $50 per month. The fare to the rider is calculated by dividing total monthly cost (rent and gas) by the number of days in service and the number of riders (less the driver). Therefore the cost to each rider varies with the total ridership.

Capital Metro's expenditures are very low. Acting only as the project manager in charge of marketing, Capital Metro's total cost in December was only $972 for the whole month or 14c per passenger trip! Unfortunately this option is not appropriate for unsubsidized trips within the Corridor because services are not cost effective if they involve less than a 30 mile round trip commute.

The second major type of vanpooling option is subsidized by Capital Metro [2]; VPSI, under contract to Capital Metro, is paid the difference between the fares collected from riders and the minimum cost of operating a van. Originally the subsidized services were designed as the way to reduce the negative impact of discontinuing two fixed route services: the Leander-Ed Bluestein Express and the Northwest Hills Express. In January of 1988, two vanpools began operating in the 183-Ed Bluestein corridor, each serving, on average 12 passengers apiece while one vanpool began in the Northwest Hills area, with much lower average ridership.

Currently Capital Metro has a system-wide fare free policy. Prior to that, each passenger paid $34/month if there were ten or fewer passengers but only $24/month if there were 13 passengers. Capital Metro's subsidy varied monthly as ridership varied but averaged from $350 - $500 per month per vanpool Now, of course, Capital Metro pays the entire cost of vanpool service. (In October of 1988 Capital Metro paid $459, $436, and $358 for each of the three services respectively [3].

Because these services have been so successful, Capital Metro decided that would help commuters in the service area to form vanpools and to receive operating subsidies [4]. Capital Metro provides interested individuals with a 1989 15-seat van and help then in securing riders. Although only a few vans were formed this way, Capital Metro is excited about the concept.

Demand Responsive Services

Capital Metro provides two demand responsive services: those provided city-wide to elderly and handicapped people, and those provided only in the 183 Corridor for residents of Lago Vista, Jonestown, and Cedar Park.

Capital Metro's only truly demand responsive option serving all destinations is the special service available to all individuals older than 70 or those who, by reason of disability, are unable to use regular buses. Capital Metro provides two types of service; Capital Metro itself provides demand responsive service for some riders in wheelchairs, using specially equipped public vehicles and Authority drivers. In addition, Capital Metro contracts with a local taxi operator to provide service for the elderly and the disabled, both those in wheelchairs and those who can ride in ordinary vehicles. The taxi operator carries almost all ambulatory riders and approximately 30% of those in wheelchairs.

The contract taxi option provides service to approximately 2,140 one-way trips/week at a cost of $8.50 per passenger (above the $ .60 fare paid by riders); this cost includes $6.96 paid to the taxi operator and $1.54 in administrative costs incurred by Capital Metro [5]. The Capital Metro demand responsive vehicles for those in wheelchairs carry approximately 3,900 riders/week at a cost of roughly $13.00 per passenger. Part of the cost differential is the lower productivity involved in serving seriously handicapped people.

Both demand responsive services have experienced significant increases in ridership in the last two years, with combined growth far ahead of the Authority's impressive 32% ridership gain. Between the beginning of 1986 and the beginning of 1989 special transit ridership increased 55%.

The Authority's other demand responsive service is a far more limited one with far less impressive ridership. Capital Metro contracts with CARTS, the federally funded rural transit provider in Travis and surrounding counties, to provide the Northwest Dial A Ride (DAR) service. The DAR operates Monday, Wednesday, and Friday from any location in Lago Vista, Jonestown, Leander, or Cedar Park to any location along the actual 183 Corridor (that is, extending beyond the artificial southern boundary of <u>this</u> study) and to specific shopping malls and medical centers in Austin.

The DAR service, which requires a 24 hour advance notice, operates only once per day, departing in the morning and returning in the early afternoon. Because of the severe limits on service, ridership has been very low and relatively stable. Ridership in the first seven months of 1989 was only 438 passenger trips (for the entire period), a 6% increase over the comparable periods in 1987 and 1988.

Capital Metro pays CARTS $21.00/vehicle hour for this service. While low, given the small ridership, the cost per passenger is higher than for the Authority's other non-traditional services.

Other Non-Traditional Services

Capital Metro also provides other services which, while far more like traditional service, are set apart by the fact that they are all delivered by private or non-profit operators under contract to the Authority. Capital Metro operates several such options including suburban feeder services and off-peak services.

Capital Metro contracts with CARTS, the rural public system, for the Northwest DAR, a feeder service **from** Lago Vista and Jonestown **to** an express bus service departing from Leander and serving the University of Texas and downtown. Ridership is high and growing; during the first seven months of 1988 there were 5,758 passenger trips, a 73% increase over the same time period in 1987. CARTS is also paid $21.00/hour for this service.

The last major non-traditional service provided by Capital Metro is off-peak and Saturday service on fixed suburban routes operated by a local taxi operator in vans. Capital Metro awarded a contract to American Cab in August of 1988 paying $34.93/revenue hour.

That cost was substantially higher than an equivalent hourly cost for elderly and handicapped service provided for Capital Metro by the same operator, and substantially higher than comparable services across the country (in higher labor cost areas). However, the service was largely experimental and the operator was required to purchase vans for which it has no other use. Recently Capital Metro negotiated the purchase of additional hours of off-peak service from American Cab at $14.95 a vehicle hour.

<u>Non-Traditional Services: Comparable Cost and Service Patterns</u>

As part of Phase Three, the Study Team contacted over a dozen cities with interesting and relevant non-traditional services and analyzed published reports covering the operations of almost 90 systems or services. Rarely were completely comparable data available on either costs or service standards but several clear patterns emerged which bear on Capital Metro's use of appropriate non-traditional options.

Several factors were of interest to the Study Team. First, the Team was concerned about a **unit cost** measure, <u>cost/vehicle hour</u>, or the total service cost, including the administrative cost borne by the contracting agency, divided by total hours in service (or revenue hours). Unfortunately the Study Team couldn't always tell if administrative costs were included in reported total or unit costs; in the Capital Metro system such costs were 18% of total costs for some services.

But cost has to be balanced with a measure of the **amount** of service provided per hour; the ultimate measure of cost-effectiveness is <u>cost per passenger trip</u>, usually total costs divided by the total number of passenger trips. Ultimately this cost figure is based on how productive the system is--how many passengers it carries during the time service is available. The most useful **productivity** measure is <u>passenger trips/vehicle hour</u>. This figure **<u>should be computed</u>** by dividing total daily (or weekly) ridership by <u>every</u> hour service is in revenue service, including the times it has no one on board.

In fact some demand responsive systems, either because they consciously wish to hide low productivity or because they don't understand the distinction, simply divide ridership by only those hours when someone requested service. Doing so greatly inflates productivity and hides the fact that vehicles may be underused for large portions of a service day (when the contractor is still being paid or the system incurring an hourly charge). Productivity figures for general public demand responsive systems over 7.0 passenger trips/hour are very suspect *

Several Tables in the Appendix summarize all relevant findings; they were too detailed and complex to present in the text. The Appendix also lists the major published work from which these findings were drawn. The major findings of this analyses are:

1) private or contracted delivery of non-traditional services was always cheaper and generally more cost-effective than public delivery of the same service, although the differential was greater for demand-responsive than vanpooling services;

2) most demand-responsive contracted services averaged between $20-$30 per vehicle hour, with the lowest costs always shown by taxi operators who operated in their traditional mode, the highest costs generally shown by transit agencies themselves operating demand-responsive services;

3) most contracted or publicly delivered vanpool services cost between $11-$20 per vehicle hour;

4) vanpool productivity was always high (80-90% of capacity) largely because such services were rarely started unless sufficient riders had already signed up;

5) demand-responsive productivity varied with the clients and the service area; it was generally much higher when service was delivered in limited areas; and

6) general public demand-responsive productivity realistically fell between 2.9 and 7.0 passenger trips/vehicle hour.

These findings are consistent with Capital Metro's own non-traditional service cost and service patterns (discussed above). In addition, they give weight to Phase One and Phase Two analyses, which found that the most appropriate services for the 183 Corridor were 1) carefully crafted vanpools for work trip commuters and 2) demand-responsive service for the general public in limited service areas.

These national cost and productivity patterns, combined with those already experienced in Austin, gave the Study Team a way to develop cost-effectiveness and implementation guidelines for non-traditional services; these were developed in Phase Four and are described in the final section of this report.

IMPLEMENTATION AND COST EFFECTIVENESS GUIDELINES- PHASE IV

The overall objective of the first three Phases of this study was to indicate non-traditional strategies appropriate for work and non-work trip needs in the 183 Corridor and elsewhere in the service area. The Study Team has suggested that two non-traditional options may be highly appropriate for the Corridor: vanpooling for major employment centers, and, demand-responsive services in three sub-areas for non-work trips.
The objective of Phase Four, described in this section, was to develop guidelines to allow

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* Productivity for systems for **the elderly and handicapped** can be higher if many people live in the same place (a community home for the mentally retarded, for example) and/or are all going to one place (a congregate meal site for the elderly). But such conditions rarely apply to **general public** demand responsive systems. Moreover systems for the handicapped often have low productivity because it takes so long to board and de-board handicapped travellers and because they often make very long trips.

Capital Metro to 1) judge if otherwise appropriate non-traditional service options are cost-effective and 2) to chose between alternative ways of delivering the same type of non-traditional services. These two issues are not, of course, mutually exclusive; one way of delivering demand responsive service may be cost-effective while another is not.

In order to facilitate those decisions the Study Team developed guidelines on the three major parameters of alternative service options: costs per vehicle hour (for all hours vehicles are in revenue service), costs per passenger trip with different productivity estimates, and subsidies per passenger trip.

Overall, the guidelines developed in Phase Four suggest that **vanpools centered on major employment sites** in the Corridor would be moderately to highly cost-effective under either public or private administration of service delivery.

Demand responsive services for non-work trips in limited areas of the Corridor would be very cost-effective if delivered by the private sector under contract to Capital Metro. These services are cheaper than fixed route service, if measured on a vehicle hour basis, and would require less subsidy per hour than fixed route service (by a factor of three to one, under some ridership estimates).

Recognizing Policy Trade-Offs

Capital Metro must make a number of trade-offs in choosing service strategies. The Study Team can provide guidelines, and does so here, but ultimately most service decisions require major policy choices. Guidelines merely provide guidance--they are not an end onto themselves.

Two very different services could have comparable service costs and even require comparable subsidies: a very expensive service may attract many riders so the cost per rider is equivalent to an inexpensive service which attracts few riders. The choice between the two options requires several major policy decisions: should the Authority chose the service that minimizes costs or the one that maximizes ridership if it can't do both?

Because transit options, traditional or non-traditional, generally require some public subsidy, a major concern is the individual and total subsidy required by each option. The subsidy, of course varies with productivity and cost, so the guidelines attempt to indicate the percentage of total operating costs which must be subsidized.

Yet as with cost and ridership figures, the service decision can't be based on subsidies alone--the decision still requires policy evaluation. Because various parts of the service area have different needs and face different problems the Authority already has varying subsidy patterns: currently some traditional routes cover as much as 25% of all costs while others cover only 4% of total costs. Moreover, some services may grow over time ultimately reducing the subsidy required; other services may never become cheaper but Capital Metro may wish to continue operations because of the nature of the users or local needs.

The two following sections each focus separately on alternative ways to organize the major types of non-traditional services identified as appropriate for the 183 Corridor by the findings of Phases One through Three: vanpooling centered on major work trip sites, and, demand-responsive services in three sub-areas of the Corridor.

Work Based Options

There are four major types of vanpooling options appropriate for the 183 Corridor although only two are currently worth deeper investigation:

1) vanpools organized and sponsored by employers (such as 3M in St. Paul and Shell in Houston),

2) vanpools organized entirely by the profit sector (such as VPSI in Austin and elsewhere),

3) vanpools operated by the transit authority (as in Knoxville) and,

4) vanpools organized by the authority but provided by private firms.

The first two options are not considered further for intra-Corridor use because private companies and employers have expressed no interest in either option.

Tables Thirty-Three and Thirty-Four focus separately on the two currently feasible options, estimating the number of vehicles required to provide needed service to each of the major employment sites under different ridership estimates, and, the costs of the option at each work site. Because of the nature of vanpooling services, there is not much difference in cost or vehicle patterns for the two services.

Table Thirty-Three illustrates the cost patterns and vehicle needs if Capital Metro were to organize and operate the service; Table Thirty-Four illustrates comparable patterns if Capital Metro only organized the service but contracted with a private provider to deliver services. The average hourly cost/vehicle hour is $16.12 for Capital Metro and $15.29 for services organized by Capital Metro but delivered by a private provider; these figures represent the average for those types of services developed from the vanpool cost data collected in Phase Three*.

Tables Thirty-Four and Thirty-Five take the vehicle requirements and hourly costs developed above and compute a) total revenue per trip under different ridership assumptions given a $72.00/month fare (the average amount VPSI currently charges in Austin), and b) the average daily subsidy required at each site with the two ridership assumptions. Table Thirty-Four focuses on vanpool services organized and operated by Capital Metro while Table Thirty-Five focuses on services contracted to a private provider.

Both Tables show that two of the work sites cannot support either type of vanpooling arrangement: the 3M facility and The Stratum. However there would be little or no subsidy required at three sites--Texas Instruments, Northwest Techniplex, and the Arboretum--if the high demand figures were accurate. In short these guidelines suggest that vanpools centered on major employment sites in the Corridor would be moderately to highly cost-effective under either type of service delivery administration, in situations where traditional fixed route service would be ineffective and inappropriate.

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* Both estimates do not include any driver labor; both options are assumed to use a driver who works at the employment destination and who provides necessary bookkeeping, etc. in exchange for free travel. The Capital Metro estimate includes vehicle acquisition and administrative costs; the private operator costs are computed from VPSI data included in the Appendix.

Table 33

COST OF RIDE-SHARING NON-TRADITIONAL OPTIONS FOR THE WORK TRIP FOR TRAVEL DISTANCES OVER TEN MILES VANPOOL OPERATED BY CAPITAL METRO

WORK-TRIP CONCENTRATION	ESTIMATED DEMAND A.M. PEAK		NUMBER OF VEHICLES REQUIRED*		TOTAL COST / A.M. TRIP^	
	HIGH	MODERATE	HIGH DEMAND	MODERATE DEMAND	HIGH DEMAND	MODERATE DEMAND
Arboretum Office Complex	20	4	2	1	$32.24	$16.12
3M	3	1	1	1	16.12	16.12
The Stratum	4	1	1	1	16.12	16.12
Texas Instruments	24	5	2	1	32.24	16.12
Northwest Techniplex	9	2	1	1	16.12	16.12

* 14 passenger vans are typically used in vanpooling operations.

^ See Appendix. It was assumed that the cost/hour is equal to the cost for an A.M. trip. The cost/hour figure ranges from $11.41 to $20.84 for other systems in operation. The average figure of $16.12 was used in this analysis.

Sources: Derived from Table Thirteen; see Appendix.

Table 34

COST OF RIDE-SHARING NON-TRADITIONAL OPTIONS FOR THE WORK TRIP VANPOOL CONTRACTED WITH A PRIVATE PROVIDER

WORK-TRIP CONCENTRATION	ESTIMATED DEMAND A.M. PEAK		NUMBER OF VEHICLES REQUIRED*		TOTAL COST / A.M. TRIP	
	HIGH	MODERATE	HIGH DEMAND	MODERATE DEMAND	HIGH DEMAND	MODERATE DEMAND
Arboretum Office Complex	20	4	2	1	$30.58	$15.29
3M	3	1	1	1	15.29	15.29
The Stratum	4	1	1	1	15.29	15.29
Texas Instruments	24	5	2	1	30.58	15.29
Northwest Techniplex	9	2	1	1	15.29	15.29

* 14 passenger vans are typically used in vanpooling operations.

Sources: Derived from Tables Thirteen; see Appendix.

Table 35

SUBSIDY REQUIRED IN RIDE-SHARING NON-TRADITIONAL OPTIONS FOR THE WORK TRIP VANPOOL OPERATED BY CAPITAL METRO

WORK-TRIP CONCENTRATION	AVERAGE TOTAL COST / A.M. TRIP^		TOTAL REVENUE PER A.M. TRIP AT A $72.00/PASS./MONTH FARE*		TOTAL SUBSIDY REQUIRED PER TRIP AT A $72.00/PASS./MONTH FARE*	
	HIGH DEMAND (13%)	MODERATE DEMAND (3%)	HIGH DEMAND (13%)	MODERATE DEMAND (3%)	HIGH DEMAND (13%)	MODERATE DEMAND (3%)
Arboretum Office Complex	$32.24	$16.12	$30.86	$5.14	$1.38	$10.98
3M	16.12	16.12	3.43	N/F	12.69	N/F
The Stratum	16.12	16.12	5.14	N/F	10.98	N/F
Texas Instruments	32.24	16.12	37.71	6.86	0.00	9.26
Northwest Techniplex	16.12	16.12	13.71	1.71	2.41	14.41

N/F: Not feasible

* Assuming 21 days per month and two trips per day. It was also assumed that the driver for each van needed does not pay any fare. $ 72.00 is the amount that VPSI currently charges a passenger riding in a van with 10 persons commuting 30 miles per day.

^ See Appendix. It was assumed that the cost/hour is equal to the cost for an A.M. trip. The cost/hour figure ranges from $11.41 to $20.84 for other systems in operation. The average figure of $16.12 was used in this analysis.

Sources: Derived from Tables Thirteen and Seventeen; see Appendix.

Table 36

SUBSIDY REQUIRED IN RIDE-SHARING NON-TRADITIONAL OPTIONS FOR THE WORK TRIP VANPOOL CONTRACTED WITH A PRIVATE PROVIDER

WORK-TRIP CONCENTRATION	AVERAGE TOTAL COST / A.M. TRIP^		TOTAL REVENUE PER A.M. TRIP AT A $72.00/PASS./MONTH FARE*		TOTAL SUBSIDY REQUIRED PER TRIP AT A $72.00/PASS./MONTH FARE*	
	HIGH DEMAND (13%)	MODERATE DEMAND (3%)	HIGH DEMAND (13%)	MODERATE DEMAND (3%)	HIGH DEMAND (13%)	MODERATE DEMAND (3%)
Arboretum Office Complex	$30.58	$15.29	$30.86	$5.14	$0.00	$10.15
3M	15.29	15.29	3.43	N/F	11.86	N/F
The Stratum	15.29	15.29	5.14	N/F	10.15	N/F
Texas Instruments	30.58	15.29	37.71	6.86	0.00	8.43
Northwest Techniplex	15.29	15.29	13.71	1.71	1.58	13.58

N/F: Not feasible

* Assuming 21 days per month and two trips per day. It was also assumed that the driver for each van needed does not pay any fare. $ 72.00 is the amount that VPSI currently charges a passenger riding in a van with 10 persons commuting 30 miles per day.

Sources: Derived from Tables Thirteen and Eighteen; see Appendix.

Non-Work Options

The findings of Phase Two and Three suggested that demand-responsive services in limited sub-areas of the Corridor would be appropriate for meeting non-work trip needs. There are three major ways to organize these services:

1) demand-responsive service in a limited area by a private operator charging for dedicated vehicle hours of service under contract to a transit authority;

2) demand-responsive service in a limited area by the transit authority; and

3) demand-responsive service by a private operator charging by the passenger trip under contract to a transit authority.

Tables Thirty-Six and Thirty-Seven illustrate the cost, vehicle requirements, and subsidy patterns of each of the three major ways to deliver community demand-responsive services, based on several ridership and productivity assumptions. The cost figures for the contract options do not include administrative costs borne by the contracting agency. The most sensitive assumptions are, indeed, those that deal with productivity, or the number of riders who use a service in each hour it is available.

The least sensitive are the cost parameters because cost patterns across the country are remarkably similar--as well as consistent with Austin's current experiences. Therefore each analyses assumes only one average cost per hour of service but computes a range of productivity figures. The analyses also consider subsidy requirements under two different fare assumptions.

Determining productivity is controversial because it is not clear why a system has only a few passengers per hour; many analysts believe that there is a "natural" limit of roughly 7.0 passenger trips/hour above which a general public system cannot go simply because the diverse origins and destinations of the riders prevent higher ridership. On the other hand, some systems do not provide very good service so that lower ridership figures may represent--not capacity constraints--but rather rational rider response to poor service.

Table Thirty-Seven indicates the number of vehicles required to service two levels of estimated demand for non-work trips in the three sub-areas of the Corridor. Table Thirty-Eight shows that the average cost per hour of service ranges from just under $18 to just over $30 with taxi operators charging by the ride being much cheaper than transit authority delivered service. Given the vehicle requirements computed in Table Thirty Seven, subsidy requirements per passenger hour range from $8 to $28, with private service delivery being the lowest and public delivery being the highest.

Overall, if measured on a vehicle hour basis, these services are both cheaper than traditional fixed route services and, because they are less costly, they require less subsidy per hour than fixed route service (by a factor of three to one, under some ridership estimates).

POLICY CONSIDERATIONS

The analyses above suggest that both vanpooling and demand-responsive services could be cost-efficient in the 183 Corridor. Much of the ultimate assessment depends on Capital Metro's overall goals and objectives and on the **actual** rather than theoretical ridership. However, Capital Metro, and other public agencies in the service area, could undertake some policies which would enhance ridership and ultimately the feasibility of these options.

Table 37

VEHICLE REQUIREMENTS FOR THE NON-WORK TRIPS

	OPTION	AVERAGE HOURLY ESTIMATED TRANSIT DEMAND	NUMBER OF VEHICLES REQUIRED HOURLY IN EACH SERVICE AREA	
			HIGH PROD. 6.0 PASS./HR.	AVG. PROD. 3.0 PASS./HR.
HIGH RIDERSHIP (3%)	Service Area, private contractor	South 46 North 46 Leander/C.P. 28	8 8 5	15 15 9
	Service Area, transit authority	South 46 North 46 Leander/C.P. 28	8 8 5	15 15 9
	Service Area, shared	South 46 North 46 Leander/C.P. 28	8 8 5	15 15 9
AVG. RIDERSHIP (1%)	Service Area, private contractor	South 15 North 15 Leander/C.P. 9	3 3 2	5 5 3
	Service Area, transit authority	South 15 North 15 Leander/C.P. 9	3 3 2	5 5 3
	Service Area, shared	South 15 North 15 Leander/C.P. 9	3 3 2	5 5 3

Source: See Technical Appendix.

Table 38

SUBSIDY REQUIRED FOR NON-WORK TRIP OPTIONS

		SUBSIDY REQUIRED/HOUR/VEHICLE			
OPTION	VEHICLE COST/HOUR (Average)	HIGH PRODUCTIVITY 6.0 PASSENGERS/HOUR		AVERAGE PRODUCTIVITY 3.0 PASSENGERS/HOUR	
		$1.00 FARE	$1.50 FARE	$1.00 FARE	$1.50 FARE
Service Area, private contractor	$26.68	20.68	17.68	23.68	22.18
Service Area, transit authority	$30.69	24.69	21.69	27.69	26.19
Service Area, shared	$17.57	11.57	8.57	14.57	13.07

Source: See Technical Appendix.

There are several policies or practices which have been used effectively elsewhere to promote transit and ridesharing. These range from subsidizing vanpools to changing parking requirements at suburban employment concentrations. Obviously some of these policies have little to do with the Transit Authority but it might be wise to help other public bodies remember how relevant are their actions to the success of transit options.

SUMMARY

Overall the Study Team found that all of the non-traditional options appropriate for the 183 Corridor would or do incur costs lower than Capital Metro's average cost/hour for fixed route bus service. With total subsidies at or below those required by conventional transit services, several non-traditional services could be implemented in the Corridor.

At least three of the major work sites--the Arboretum, Texas Instruments, and Northwest Techniplex--might be appropriate candidates for vanpooling types of non-traditional transit services. Services could be cost-effectively delivered to these sites by either the Transit Authority or private contractors; in some circumstances no subsidy would be required at all.

The study area could be divided into three sub-areas, each being served by a separate but comparable demand responsive service focused largely on non-work trips. In general, private providers would be more cost-effective, although public subsidies would still be required. The subsidy required by the least expensive options would be roughly one third of Capital Metro's current cost per vehicle hour.

NOTES

1. Estimates provided by Nancy Edmonson in a July 19, 1988 memo; these are the marginal costs of providing new or small-scale additional services. They are more than double the average cost per revenue hour for the entire system.

2. Information provided by Howard Goldman, Capital Metro, Dec. 9, 1988.

3. Data supplied by Howard Goldman, Capital Metro, December 9, 1988.

4. "Funding begins for vanpools operating in CMTA service area; success of pilot program sets new policy," Capital Metro Star, vol. 4, no. 3, Winter 1988, p. 7.

5. These cost and ridership figures were estimates for August 1988 made by Nancy Edmonson, Capital Metro.

SUMMARY TECHNICAL APPENDIX

DATA AND DEFAULT SOURCES

The City of Austin Office of Land Development Services and the Division of Planning and Growth Management (both now incorporated into one City Planning Department), were major sources of information on land use, employment, and population characteristics in the Corridor. The land use and economic information supplied by the Austin Planning Department was augmented by several windshield surveys undertaken by the Study Team in July of 1988. Additional demographic information was obtained directly or indirectly from the Austin Transportation Study (ATS). Texas Instruments and 3M, two large employers in the Corridor, also provided useful employment information; VPSI, a private vanpool operator, provided cost specifications.

In order to conduct the transportation analyses required in each Phase, (for example to predict the number of shopping trips attracted to each of the Corridor's Shopping Centers), the Study Team developed detailed spreadsheet models. To address local data deficiencies the Team used a series of "proxy" or default measures derived from several sources:

1) the Institute of Traffic Engineering's (ITE) Trip Generation Manual,

2) published and unpublished data from the 1983 National Personal Transportation Study (NPTS),

3) published and tape-readable data from the 1980 U.S. Census of Austin by census tract and city-wide, and,

4) Austin-specific data developed by other researchers or studies, particularly the Capital Metro 1988 Marketing Baseline Study (by Nustats).

Because the Study Team needed analytical data at the Traffic Serial Zone level--small geographic units widely used in transportation planning--a number of conversions between census tracts, traffic zones, and zip codes were required. Since the boundaries of these various units did not always match, some estimation was required. The second Technical Appendix describes the conversion factors and the boundary estimates.

METHODOLOGY BY PHASE

PHASE ONE-DEMOGRAPHIC ANALYSIS

The Study Team based these analyses on three major data sources:

1) 1980 published Census data for Austin by Census track;

2) 1985 population and socio-demographic data available by Traffic Serial Zone, prepared by Capital Metro, the City of Austin, and ATS.

3) a 1% sample of Austin's 1980 Census data available on tape (PUMS) for Austin city-wide; and

In addition, data from the Capital Metro marketing and on-board studies were used to supplement the Census data.

The first two sources, data available from the published 1980 Census, as updated by City of Austin data and Capital Metro, were the foundation of the evaluations of Corridor specific socio-demographic characteristics.

The analyses of transit and carpool use were based on tape readable Public Use Micro-Sample data (PUMS), a product of the 1980 Census; the PUMS data set ultimately represents a 1% sample of the Austin population. The PUMS data allowed the Study Team to formulate its own questions and cross-tabulations and not to rely simply on published Census tables.

Unfortunately, the PUMS data set suffers from several serious deficiencies, two of which it shares with all Census data: 1) there are only four transportation questions in the Census, all relating to home-to-work travel; 2) less than 40% of all transportation responses were coded by Census because of financial constraints; 3) the PUMS data set deletes most locational information to protect the anonymity of households; and 4) the sample size become very small when the 1% sample is disaggregated (for example, by sex, car ownership, hours worked per week, mode to work, etc.)

PHASE TWO-MAJOR TRIP ATTRACTORS

The Study Team identified major employment and non-employment work sites, and calculated the number of square feet in each, using data available from the Division of Planning and Growth Management which had prepared Sector Reports for the two sectors in which the 183 Corridor sits, and, from detailed land use maps prepared by the Office of Land Development Services. These sources were confirmed and updated by several windshield surveys in the summer of 1988; the Team actually measured several sites.

Once major sites had been identified , the Study Team used different methods to estimate the number of residents' trips drawn to the five employment and to the five shopping/personal business sites.

Work Trip Calculations

The Study Team estimated trips drawn to major employment sites by 1) obtaining or calculating employment at each site and 2) estimating how many of these employees actually lived in the Corridor. Then the Study Team 3) gauged the range of potential non-traditional transit riders by estimating the number of employees in the Corridor who lived ten miles or more away form their jobs--since national data indicate few potential vanpoolers live closer than that to work.

Actual employment figures were available only for Texas Instruments and 3M and one office building in the Arboretum complex; employment figures were calculated for the remaining three sites, using national default data on vacancy rates and ITE rates on the number of employees per square foot of different types of commercial and industrial space. Then these employment figures were divided--based on a mixture of actual data and estimates--into work trips originating in the Corridor and those originating outside the Corridor.

Since Texas Instruments gave the Study Team the zip codes of all Texas Instruments employees it was relatively easy to estimate the number of TI employees actually living in the Corridor (roughly one-third); the only difficulty was that some zip codes extended beyond the boundaries of the Corridor. The Texas Instruments figures are shown in the table below.

Non-Work Trip Calculations

The Study Team calculated trips drawn to non-employment attractors by 1) estimating the number of non-work trips generated by households in the Corridor and then 2) distributing these trips among the potential sites within the Corridor.

The Study Team calculated non-work trips by housing type (ie single family, multi-family, and mobile home) using Austin Planning Department data to identify housing types by Traffic Serial Zones (TSZ), using ITE default data on trip production by household type to calculate total trips by households and ultimately by TSZ, and using NPTS default data on the percentage of all non-work trips taken for particular non-work purposes to divide non-work trips into specific categories (ie shopping, medical, etc.).

The Study Team distributed those specific kinds of non-work trips to the various sites using NPTS default data on average trip length by specific trip purpose. Detailed descriptions of these procedures, and the default values and assumptions underlying them, are described in the second Technical Appendix.

TECHNICAL APPENDIX II

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SOCIO-ECONOMIC CHARACTERISTICS OF THE 183 CORRIDOR

SOCIO-ECONOMIC CHARACTERISTICS OF THE 183 CORRIDOR

Traffic Zone	Census Tract in Which T.Z. is Located	1985 Total Population	1985 Occupied Units	Occupied Household Size	Percent People Over 65	Number People Over 65	% Total Pop Public Trans Disability 16-64
1	203	977	386	2.53	5	49	0.60
2	203	3224	1168	2.76	5	161	0.60
3	203	1667	604	2.76	5	83	0.60
7	203	1963	725	2.71	5	98	0.60
103	203	173	63	2.76	5	9	0.60
110	203	779	288	2.7	5	39	0.60
117	203	1553	574	2.71	5	78	0.60
118	203	0	0	0	5	0	0.60
151	204	5131	1574	3.26	3	154	0.11
152	204	1445	444	3.25	3	43	0.11
153	204	974	293	3.32	3	29	0.11
154	204	827	249	3.32	3	25	0.11
161	204	2444	750	3.26	3	73	0.11
162	204	64	20	3.2	3	2	0.11
163	204	2898	931	3.11	3	87	0.11
164	204	1941	598	3.25	3	58	0.11
165	204	1717	571	3.01	3	52	0.11
166	204	126	38	3.32	3	4	0.11
168	204	2028	658	3.08	3	61	0.11
169	204	1803	543	3.32	3	54	0.11
177	17.09	1195	410	2.91	2	24	0.24
178	17.1	427	128	3.34	3	13	0.48
179	17.1	1002	334	3	3	30	0.48
180	17.1	3225	1075	3	3	97	0.48
181	17.1	2309	1021	2.26	3	69	0.48
182	17.1	544	292	1.86	3	16	0.48
183	17.08	2048	756	2.71	8	164	0.31
186	17.09	767	264	2.91	2	15	0.24
187	204	0	0	0	5	0	0.11
188	17.09	2889	993	2.91	2	58	0.24
189	17.09	591	203	2.91	2	12	0.24
190	17.09	2406	819	2.94	2	48	0.24
191	17.08	1436	472	3.04	8	115	0.31
194	17.09	45	15	3	2	1	0.24
195	17.09	0	0	0	2	0	0.24
196	17.09	617	212	2.91	2	12	0.24
197	17.09	783	270	2.9	2	16	0.24
198	17.09	2024	673	3.01	2	40	0.24
199	17.08	4361	1510	2.89	8	349	0.31
214	17.09	798	266	3	2	16	0.24
215	17.08	0	0	0	8	0	0.31
567	203	484	179	2.7	5	24	0.60
573	205	26	10	2.6	2	1	0.65
574	205	7	3	2.33	2	0	0.65
Totals		59718	20382			2279	
						3.80%	

Source: U.S. Census, Vol. 45, 1980, Tables H-7,P-9,P-10 & P-11 and tape readable data on Socio - Economic characteristics of Traffic Serial Zones provided by Capital Metro.

SOCIO-ECONOMIC CHARACTERISTICS OF THE 183 CORRIDOR
(continued)

Traffic Zone	Number Public Trans Disabilty 16-64	% Total Pop Public Trans Disability 65 & over	Number Public Trans Disabilty 65 & over	% Pop Below Poverty Level 65 & over	Number Below Poverty Level 65 & over	% Total Pop Below Poverty Level
1	6	0.78	8	1.22	12	7.82
2	19	0.78	25	1.22	39	7.82
3	10	0.78	13	1.22	20	7.82
7	12	0.78	15	1.22	24	7.82
103	1	0.78	1	1.22	2	7.82
110	5	0.78	6	1.22	9	7.82
117	9	0.78	12	1.22	19	7.82
118	0	0.78	0	1.22	0	7.82
151	6	1.05	54	-	-	3.82
152	2	1.05	15	-	-	3.82
153	1	1.05	10	-	-	3.82
154	1	1.05	9	-	-	3.82
161	3	1.05	26	-	-	3.82
162	0	1.05	1	-	-	3.82
163	3	1.05	31	-	-	3.82
164	2	1.05	20	-	-	3.82
165	2	1.05	18	-	-	3.82
166	0	1.05	1	-	-	3.82
168	2	1.05	21	-	-	3.82
169	2	1.05	19	-	-	3.82
177	3	0.56	7	0.12	1	2.93
178	-	-	-	-	-	4.10
179	-	-	-	-	-	4.10
180	-	-	-	-	-	4.10
181	-	-	-	-	-	4.10
182	-	-	-	-	-	4.10
183	6	0.20	4	-	-	3.90
186	2	0.56	4	0.12	1	2.93
187	0	1.05	0	-	-	3.82
188	7	0.56	16	0.12	4	2.93
189	1	0.56	3	0.12	1	2.93
190	6	0.56	13	0.12	3	2.93
191	4	0.20	3	-	-	3.90
194	0	0.56	0	0.12	0	2.93
195	0	0.56	0	0.12	0	2.93
196	2	0.56	3	0.12	1	2.93
197	2	0.56	4	0.12	1	2.93
198	5	0.56	11	0.12	2	2.93
199	13	0.20	9	-	-	3.90
214	2	0.56	4	0.12	1	2.93
215	0	0.20	0	-	-	3.90
567	3	0.78	4	1.22	6	7.82
573	0	0.20	0	0.32	0	4.10
574	0	0.20	0	0.32	0	4.10
Totals						

Source: U.S. Census, Vol. 45, 1980, Tables H-7,P-9,P-10 & P-11 and tape readable data on Socio - Economic characteristics of Traffic Serial Zones provided by Capital Metro.

SOCIO-ECONOMIC CHARACTERISTICS OF THE 183 CORRIDOR
(continued)

Traffic Zone	Number of Total Pop Below Poverty Level	Household Units Below Poverty Level	% HH 0 Vehicles	Number HH 0 Vehicles	% HH 1 Vehicle	Number HH 1 Vehicle	% HH 2 Vehicles
1	76	30	2.93	11	19.13	74	44.35
2	252	91	2.93	34	19.13	223	44.35
3	130	47	2.93	18	19.13	116	44.35
7	153	57	2.93	21	19.13	139	44.35
103	14	5	2.93	2	19.13	12	44.35
110	61	23	2.93	8	19.13	55	44.35
117	121	45	2.93	17	19.13	110	44.35
118	0	0	2.93	0	19.13	0	44.35
151	196	60	1.20	19	17.20	271	53.92
152	55	17	1.20	5	17.20	76	53.92
153	37	11	1.20	4	17.20	50	53.92
154	32	10	1.20	3	17.20	43	53.92
161	93	29	1.20	9	17.20	129	53.92
162	2	1	1.20	0	17.20	3	53.92
163	111	36	1.20	11	17.20	160	53.92
164	74	23	1.20	7	17.20	103	53.92
165	66	22	1.20	7	17.20	98	53.92
166	5	1	1.20	0	17.20	7	53.92
168	77	25	1.20	8	17.20	113	53.92
169	69	21	1.20	7	17.20	93	53.92
177	35	12	0.43	2	17.90	73	55.82
178	17	5	-	-	7.31	9	56.64
179	41	14	-	-	7.31	24	56.64
180	132	44	-	-	7.31	79	56.64
181	95	42	-	-	7.31	75	56.64
182	22	12	-	-	7.31	21	56.64
183	80	29	-	-	16.74	127	52.86
186	22	8	0.43	1	17.90	47	55.82
187	0	0	1.20	0	17.20	0	53.92
188	85	29	0.43	4	17.90	178	55.82
189	17	6	0.43	1	17.90	36	55.82
190	70	24	0.43	3	17.90	147	55.82
191	56	18	-	-	16.74	79	52.86
194	1	0	0.43	0	17.90	3	55.82
195	0	0	0.43	0	17.90	0	55.82
196	18	6	0.43	1	17.90	38	55.82
197	23	8	0.43	1	17.90	48	55.82
198	59	20	0.43	3	17.90	120	55.82
199	170	59	-	-	16.74	253	52.86
214	23	8	0.43	1	17.90	48	55.82
215	0	0	-	-	16.74	0	52.86
567	38	14	2.93	5	19.13	34	44.35
573	1	0	1.67	0	11.17	1	58.67
574	0	0	1.67	0	11.17	0	58.67
Totals				212		3315	
				1.00%		16.30%	

Source: U.S. Census, Vol. 45, 1980, Tables H-7,P-9,P-10 & P-11 and tape readable data on Socio - Economic characteristics of Traffic Serial Zones provided by Capital Metro.

SOCIO-ECONOMIC CHARACTERISTICS OF THE 183 CORRIDOR
(continued)

Traffic Zone	Number HH 2 Vehicles	% HH 3+ Vehicles	Number HH 3+ Vehicles	% Families Female HH Head	Number Families Female HH Head	% People Under 18 Poverty Status	Number People Under 18 Poverty Status
1	171	33.59	130	5.65	22	3.44	34
2	518	33.59	392	5.65	66	3.44	111
3	268	33.59	203	5.65	34	3.44	57
7	322	33.59	244	5.65	41	3.44	68
103	28	33.59	21	5.65	4	3.44	6
110	128	33.59	97	5.65	16	3.44	27
117	255	33.59	193	5.65	32	3.44	53
118	0	33.59	0	5.65	0	3.44	0
151	849	27.68	436	4.52	71	1.67	86
152	239	27.68	123	4.52	20	1.67	24
153	158	27.68	81	4.52	13	1.67	16
154	134	27.68	69	4.52	11	1.67	14
161	404	27.68	208	4.52	34	1.67	41
162	11	27.68	6	4.52	1	1.67	1
163	502	27.68	258	4.52	42	1.67	49
164	322	27.68	166	4.52	27	1.67	32
165	308	27.68	158	4.52	26	1.67	29
166	20	27.68	11	4.52	2	1.67	2
168	355	27.68	182	4.52	30	1.67	34
169	293	27.68	150	4.52	25	1.67	30
177	229	25.14	103	6.89	28	1.15	14
178	72	36.05	46	4.81	6	1.95	8
179	189	36.05	120	4.81	16	1.95	20
180	609	36.05	388	4.81	52	1.95	63
181	578	36.05	368	4.81	49	1.95	45
182	165	36.05	105	4.81	14	1.95	11
183	400	30.40	230	5.47	41	1.46	30
186	147	25.85	68	6.89	18	1.15	9
187	0	27.68	0	4.52	0	1.67	0
188	554	25.85	257	6.89	68	1.15	33
189	113	25.85	52	6.89	14	1.15	7
190	457	25.85	212	6.89	56	1.15	28
191	250	30.40	143	5.47	26	1.46	21
194	8	25.14	4	6.89	1	1.15	1
195	0	25.85	0	6.89	0	1.15	0
196	118	25.85	55	6.89	15	1.15	7
197	151	25.85	70	6.89	19	1.15	9
198	376	25.85	174	6.89	46	1.15	23
199	798	30.40	459	5.47	83	1.46	64
214	148	25.85	69	6.89	18	1.15	9
215	0	30.40	0	5.47	0	1.46	0
567	79	33.59	60	5.65	10	3.44	17
573	6	28.50	3	5.65	1	1.82	0
574	2	28.50	1	5.65	0	1.82	0
Totals	10734		6115		1094		1133
	1		30%		5.40%		5.60%

Source: U.S. Census, Vol. 45, 1980, Tables H-7,P-9,P-10 & P-11 and tape readable data on Socio - Economic characteristics of Traffic Serial Zones provided by Capital Metro.

INFORMATION ON AUSTIN TRANSPORTATION PATTERNS

Mode to Work by Age, Austin, 1980

Age	Car*	Public Transit	Other**
16-19	100.0	-	-
20-29	90.6	3.5	5.9
30-39	92.2	2.7	5.1
40+	89.5	1.9	8.6

* Includes drivers and passengers.
** Includes walking, cycling and working at home.

SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

Mode to Work by Sex, Austin, 1980

Sex	Car*	Public Transit	Other**
Male	91.9	1.8	6.3
Female	89.7	3.9	6.4

* Includes drivers and passengers.
** Includes walking, cycling and working at home.

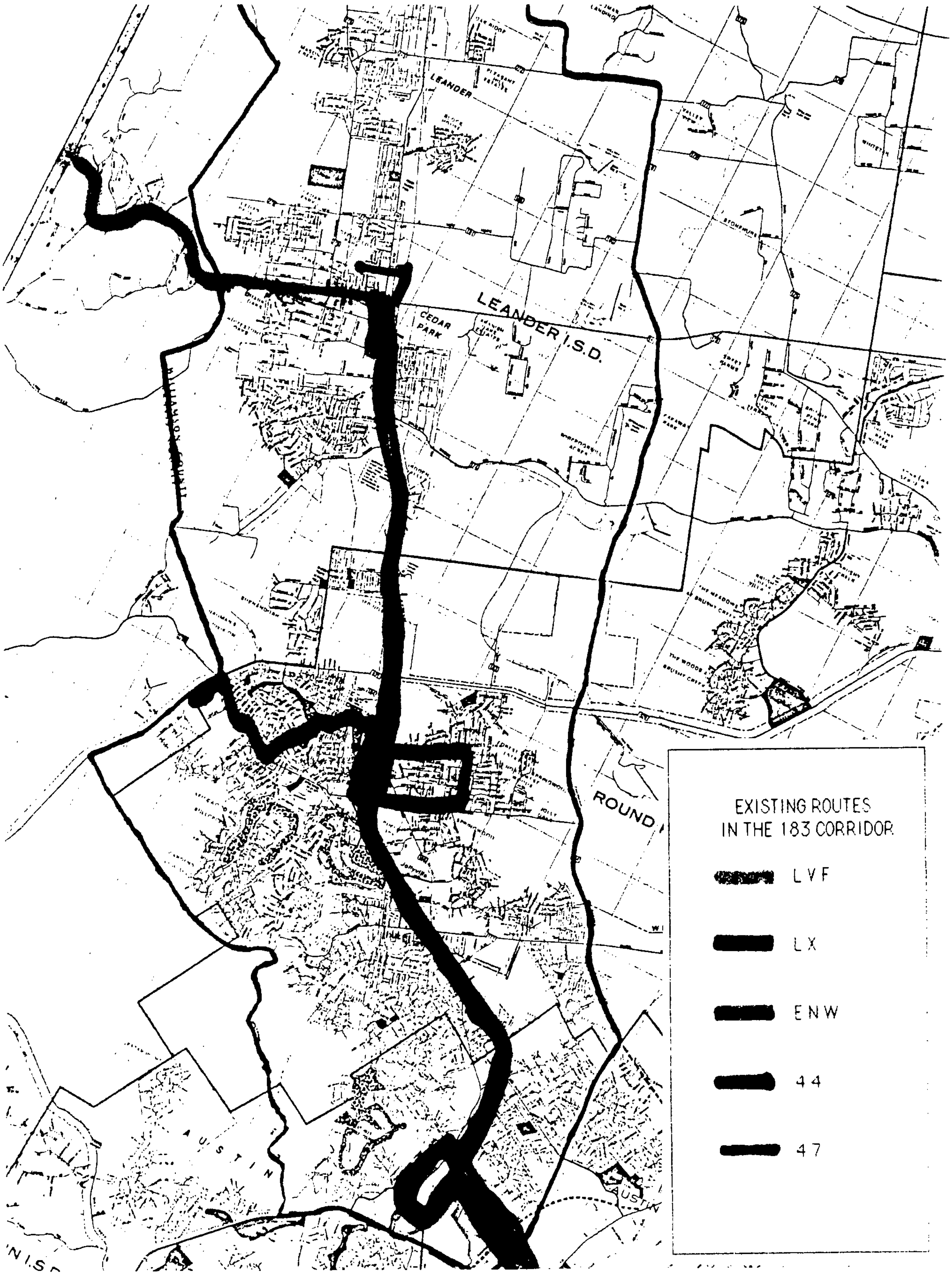
SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

Size of Carpool by Household Income, Austin 1980

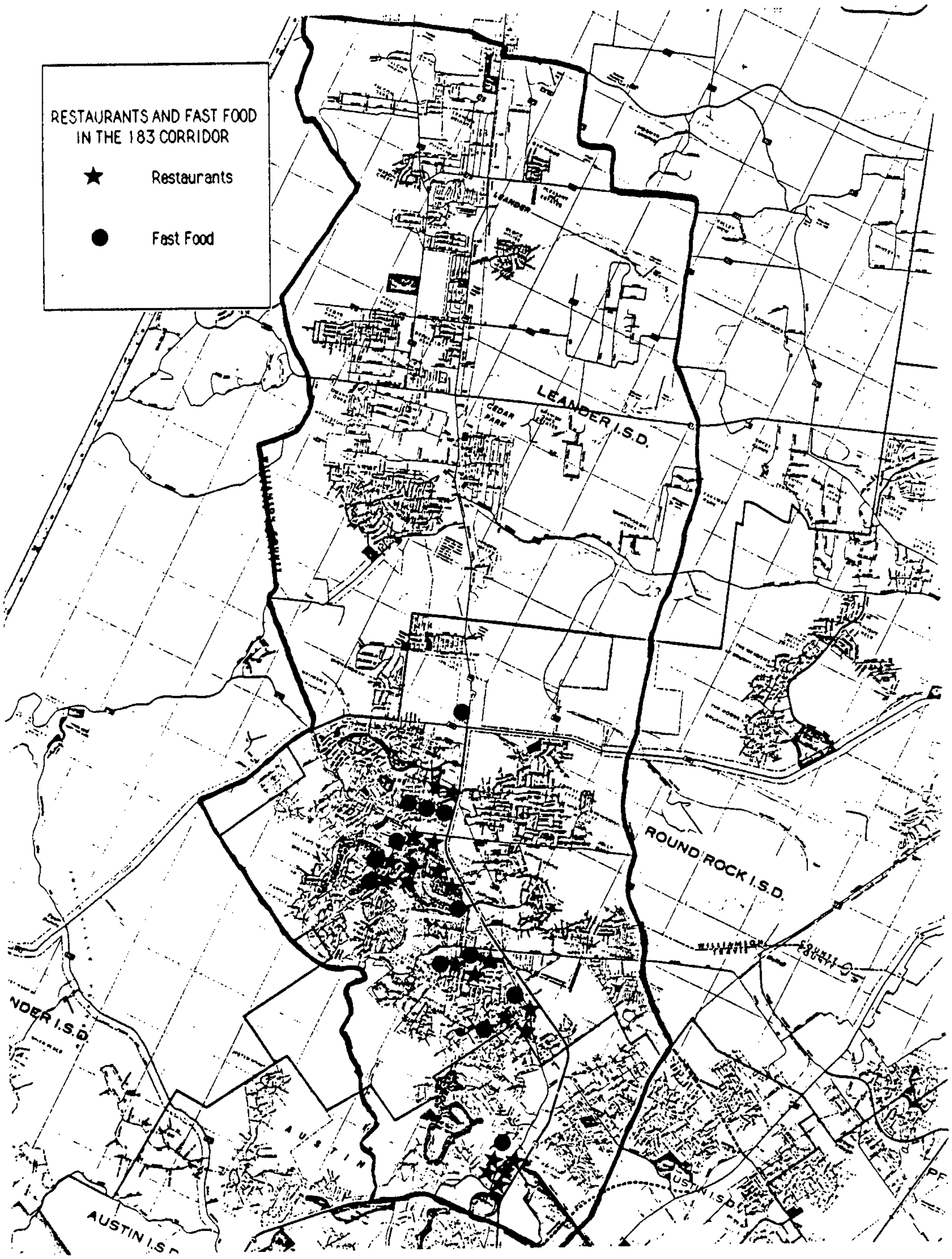
Household Income	Number of People in Carpool		
	Two	Three	Four
Under 5,000	91.7	8.3	0.0
5,000 - 9,999	82.5	10.0	2.5
10,000 - 14,999	79.3	15.5	3.4
15,000 - 19,999	60.3	30.2	4.8
20,000 - 24,999	71.2	9.6	13.5
25,000 - 29,999	62.9	14.3	22.9
30,000 - 34,999	66.7	15.2	12.1
35,000 - 39,999	72.7	13.6	4.6
More than 40,000	75.0	20.8	0.0

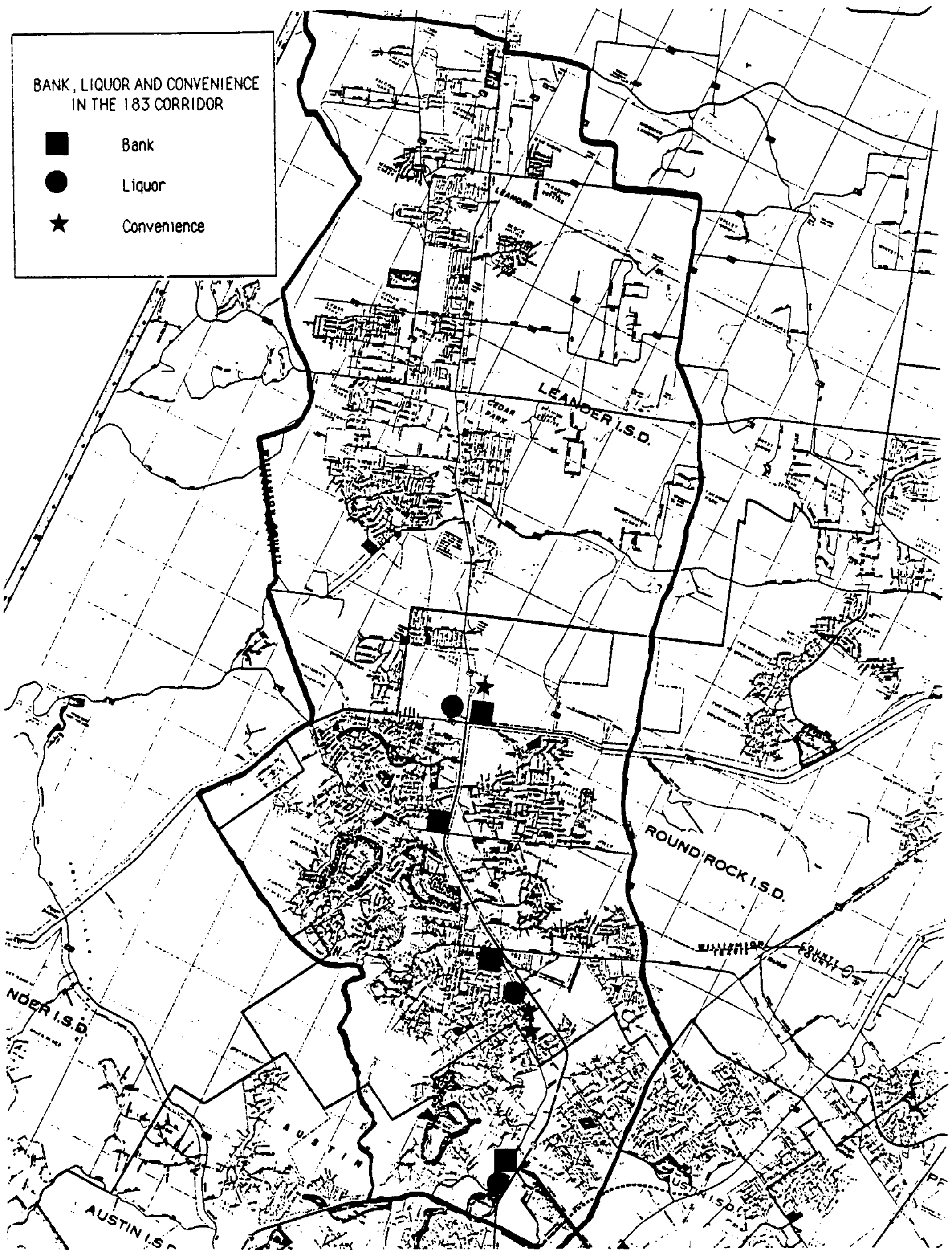
SOURCE: Derived from the U.S. Bureau of the Census (1983), Census of Population and Housing, 1980, Public Use Microdata, Sample B, Texas.

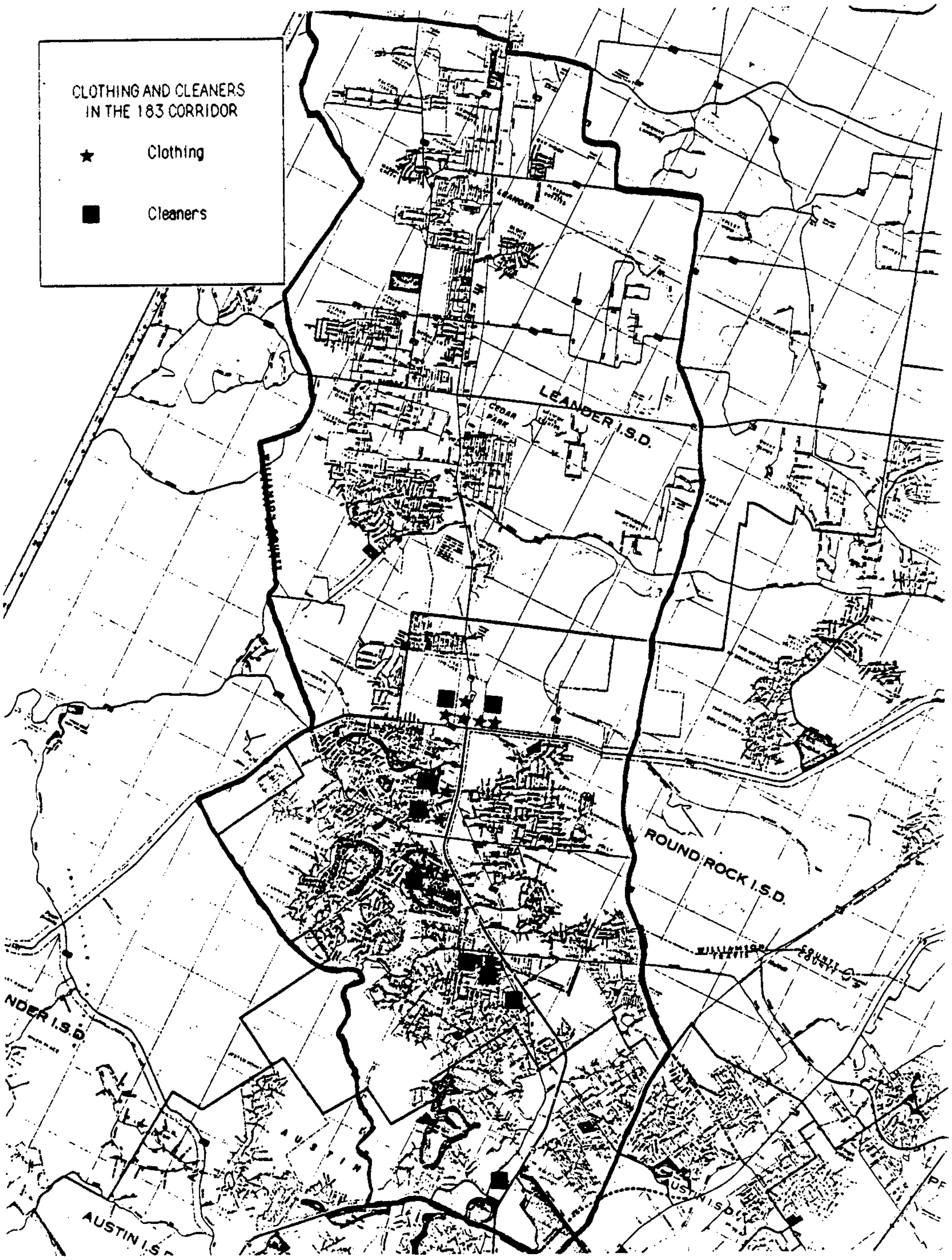
EXISTING ROUTES IN THE 183 CORRIDOR

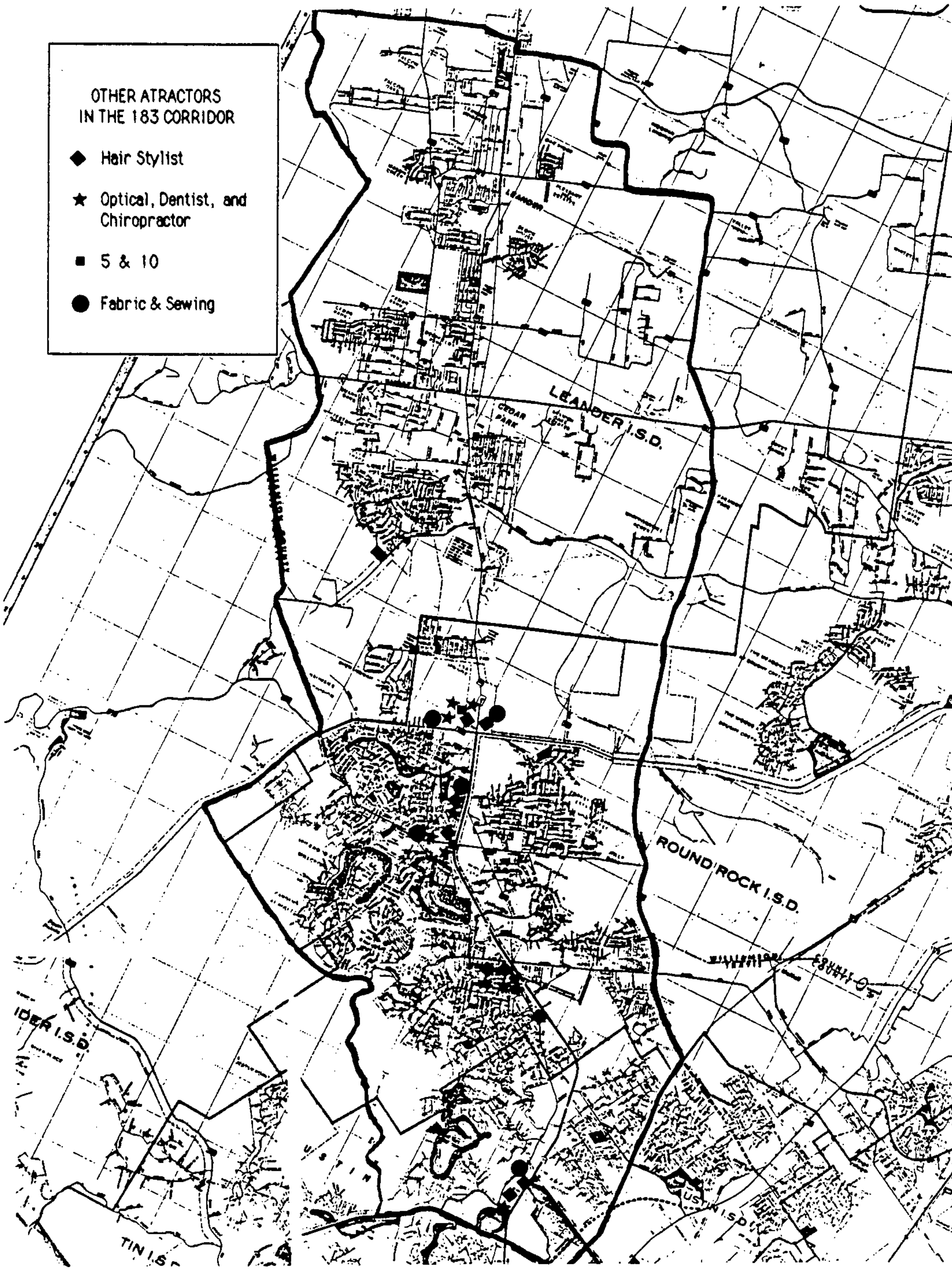

LEANDER
LEANDER I.S.D.
CEDAR PARK
ROUND
AUSTIN
EXISTING ROUTES
IN THE 183 CORRIDOR
LVF
LX
ENW
44
47

COMMERCIAL ACTIVITY IN THE 183 CORRIDOR


RESTAURANTS AND FAST FOOD
IN THE 183 CORRIDOR
Restaurants
Fast Food
LEANDER I.S.D.
ROUND ROCK I.S.D.
AUSTIN I.S.D.


BANK, LIQUOR AND CONVENIENCE
IN THE 183 CORRIDOR
Bank
Liquor
Convenience
LEANDER I.S.D.
ROUND ROCK I.S.D.
AUSTIN
AUSTIN I.S.D.
NDER I.S.D.


CLOTHING AND CLEANERS
IN THE 183 CORRIDOR
Clothing
Cleaners
LEANDER I.S.D.
ROUND ROCK I.S.D.
AUSTIN I.S.D.


OTHER ATRACTORS
IN THE 183 CORRIDOR
Hair Stylist
Optical, Dentist, and Chiropractor
5 & 10
Fabric & Sewing
LEANDER I.S.D.
ROUND ROCK I.S.D.

LIST OF STORES

SHOPPING CENTER COMPLEX ANCHOR STORE

SKAGG'S

(Anderson Mill Road)

Home video
Sally Beauty Supply
Flowers
Lone Star Cafe
Vic's Corn Popper
vacant
SAS shoes
GIVING tree
Fabric Gallery
Vic Self Chem
chiropractor
Yankee Clipper
Conan Pizza
TCBY Yogurt
Sylvan Learning Center
Austin Driving School
Whataburger
Fitness Center
Brotherss II Cleaners
Mazzio Pizza
vacant
Herart O' Texas Savings
Wal greens
Gulf
Burger King
NorthWest Music
Blockbuster Video
Nanking Chinese Restaurant
Golden Life Fitness Center
La Morada Mexican restaurant
Hardware Store
Ben Franklin crafts
Shipley Donuts
Golden Fried Chicken
Royal Optical

HEB & SAFEWAY

(Highway 620)

The Bottle Shop liquor
Chiropractor
A Corner Bookstore
Barry's Children's Shoes
Torres Hair Designs
Party Palace
Sub Shop
Young at Heart Toy Shop
Texas Tax service
Austin Beauty Supply
Austin Travel and Tours
Clear Cut Opticians
Jack Brown cleaners
Schauer and Turner dentists
Marshall and Co jewlers
vacant
Yaring's
House of Tuxedo and Bridal
Payless Shoes
Bright Bank
Linen Mill Outlet
K-Mart
7-11
Comet Cleaners
Eckerd's
Great West Savings
Federal Express
Michael's Crafts
Suzanne's women's clothes
Floor King
Austin Vacuum Cleaner
The Connection shoes
Agape Christian Bookstore
Noah's Toy Shop
London Fabrics
Freytag's Florist
SunTana
Paint Shop
Supercuts
Video Station
Merle Norman Cosmetics
One Hour Photo
5 vacant bays

LIST OF STORES

SHOPPING CENTER COMPLEX ANCHOR STORE

SAFEWAY (Balcones Woods)	PIC n SAVE & TOM THUMB (Spicewoods Springs)	SIMON DAVID (Arboretum)
Bill Miller's	Short Stop	Arboretum shopping mall
Mc Donald's	Diamond Shamrock	
Jack Brown Cleaners	Lamar Savings	
Hair It Is	The Pit Bar B Que	
Budget Rent to Own	Time Masters Watch Repair	
Laundrymat	Revco	
Mail Bocws Etc.	Roslyn's Hallmark	
Kwik Kopy	Radio Shack	
Chiropractor	Harrel's Hardware	
Bernina SewingCenter	Weiner's	
Aardvark video	Little Caesar's	
Gibraltar Savings	Asia Market Grocery	
Eckerd's	Edwin's Jewelry	
Jeff's Liquors	Craft Connection	
Freytag's Florist	Simpson's Barber	
Shin Yuan chinese Restaurant	Olan Mills	
Wanderlust Travel	Bait Shop	
Nane Tamers	Winn's	
Nail Boutique	Shoe Repair	
Back in a Flash	Rainbow Thrift Store	
Mr. Gatti'ss	Merle Norman Cosmetics	
Lamp Shop	Dynasty Chinese Restaurant	
Cafe Roma	Award Masters	
Casita Jorges	Wilbur dentist	
Austin Shoe Hospital	Mrs. Baird's Thriift Store	
	Hair by us	
	Jack Brown Cleaners	
	Double Eagle Coins	
	Sally's Typing Etc.	
	Ripley Realtors	
	Murfido Commodities tax service	
	Herbal Nutrition	
	Glenn Maass Insuraance	
	Capitol Hearing Aids	
	Birdsong dentist	
	Travel agent	
	United Videos	
	Capital City Savings	
	Florist	
	Cleaaners	
	Jim's Restaurant	

MAJOR NON-WORK TRIP ATTRACTORS

ANCHOR STORE	LOCATION	APPROXIMATE SQUARE FOOTAGE OF THE ANCHOR STORE	APPROXIMATE NUMBER OF PERSONS ATTRACTED TO THE ANCHOR STORE PER DAY
Safeway	Balcones Woods	40,000	2,000
Simon David	Arboretum	N/A	N/A
Pick & Save	Mc.Neil Road	32,000	N/A
Tom Thumb	Mc.Neil Road	40,000	N/A
Skaggs	Anderson Mill	62,000	3,000
Safeway	Highway 620	52,000	N/A
HEB	Highway 620	N/A	N/A

Source: Telephone interviews with store managers.

CHARACTERISTICS OF NON-TRADITIONAL TRANSIT OPTIONS OPERATED OR CONTRACTED BY CAPITAL METRO

GENERAL CHARCTERISTICS OF NON TRADITIONAL TRANSIT OPTIONS OPERATED OR CONTRACTED BY CAPITAL METRO

TYPE OF SERVICE	PROVIDER	ROUTE	VEHICLES
GENERAL PUBLIC			
FIXED ROUTE			
Off-Peak and Saturday fixed suburban route	American Cab	42	14 passenger vans
Saturday fixed suburban route	American Cab	39	14 passenger vans
OTHER			
Express (4 trips per day)	American Cab	Oak Hill Express	14 passenger vans
Vanpools (from nearby towns to the CBD)	VPSI		14 passenger vans
Demand responsive (Monday, Wednesday and Friday service from Lago Vista, Jonestown, Leander and Cedar Park to locations along the 183 corridor and to some shopping malls and medical centers in Austin)	CARTS	Northwest DAR	Vans
Feeder Service from Lago Vista and Jonestown to an express bus service to downtown and the University of Texas	CARTS	LVF	Vans
ELDERLY AND HANDICAPPED			
Special Transit Services for the ambulatory elderly and the handicapped	American Cab	STS	Taxis
Special Transit Services for the elderly and handicapped. Only for qualified, registered individuals	CMTA	STS	Special vehicles

Sources: Capital Metro cost model for December 1987, conversations with CMTA officials, CMTA route maps, and Capital Metro's 1988 Boarding and Alighting Survey.

COST, FARES AND RIDERSHIP OF THE NON TRADITIONAL TRANSIT OPTIONS OPERATED OR CONTRACTED BY CAPITAL METRO

TYPE OF SERVICE	COST TO CMTA	FARE	RIDERSHIP
GENERAL PUBLIC			
FIXED ROUTE			
Off-Peak and Saturday fixed suburban route	$34.93/rev. hour	25¢ for chilren, elderly and disabled. 50¢ all others.	5 riders / trip (from the 1988 boarding and alighting survey)
Saturday fixed suburban route	$34.93/rev. hour	25¢ for chilren, elderly and disabled. 50¢ all others.	6 riders / trip (from the 1988 boarding and alighting survey)
OTHER			
Express (4 trips per day)	$34.93/rev. hour	$1.00	4 riders / trip (from the 1988 boarding and alighting survey)
Vanpools (from nearby towns to the CBD)	$0.14/pass. or $972/month*	See next page	There are 12 vans carrying approximately 13 riders/ trip
Demand responsive (Monday, Wednesday and Friday service from Lago Vista, Jonestown, Leander and Cedar Park to locations along the 183 corridor and to some shopping malls and medical centers in Austin)	$21/veh. hour	60 ¢ for persons 65 and older and for disabled. $1.00 for all others.	23 passengers / week (July 1988)
Feeder Service from Lago Vista and Jonestown to an express bus service to downtown and the University of Texas	$21/veh. hour	25¢ for chilren, elderly and disabled. 50¢ all others.	191 passengers / week (July 1988)
ELDERLY AND HANDICAPPED			
Special Transit Services for the ambulatory elderly and the handicapped	$6.95/pass. ** $8.47/pass.***	60¢	2,140 riders / week (July 1988)
Special Transit Services for the E & H Only for qualified, registered individuals	$47.32/veh. hour (December 1988)	60¢	3,939 riders / week (July 1988)

* Capital Metro acts as the project manager, in charge of marketing, management and facilitating contacts. The cost shown is the allocated administrative cost for December 1987.

** Amount paid to the taxi company (December 1987).

*** Total cost which includes the amount paid to the taxi company and the internal administrative cost (December 1987).

Sources: Capital Metro cost model for December 1987, conversations with CMTA officials, CMTA route maps, and Capital Metro's 1988 Boarding and Alighting Survey.

VPSI

2100 N. Highway 360
Suite 2200A
Grand Prairie, TX 75050-1015
(214) 988-8458

Fare Estimates - 15-passenger vans (1987 Model)

($560.00 per month fixed cost; $.05, $.06 or $.07 per commute mile for gasoline, assumes $.90 per gallon of gasoline and 10 mpg; 21 working days per month; excludes parking costs; fare estimates rounded to the nearest dollar for ease of discussion)

Commute	Number of paying passengers in the vanpool group					
Miles/Day	14	13	12	11	10	9	Driver
30	$46	$50	$54	$59	$65	$72	$-0-
40	48	52	56	61	67	74	-0-
50	50	54	58	63	70	77	-0-
60	52	56	60	66	72	80	-0-
70	53	58	62	68	75	83	-0-
80	55	59	64	70	77	86	-0-
90	57	61	66	72	80	88	-0-
100	60	65	70	77	84	94	-0-

(Based upon current economic conditions. Subject to change)

FARE CALCULATION: 1) Daily round trip miles x 21 days per month x per mile operational cost equals the total operational cost per month per van, 2) Daily round trip miles x 21 days per month divided by 10 miles per gallon x $.90 per gallon equals total gasoline cost per month per van, 3) the operational cost added to the gasoline cost plus the fixed cost per month divided by the number of paying passengers equals the passenger fare per month.

OPERATING CHARACTERISTICS
SEVERAL SYSTEMS

OPERATING CHARACTERISTICS SEVERAL SYSTEMS

SYSTEM	LOCATION	TARGET POP	SERVICE AREA (SQ. MILES)	DENSITY (POP/ SQ. MILE)	AVERAGE WEEKDAY RIDERSHIP	TRIPS/ DAY/ RESIDENT	PASS./ VEHICLE-HOUR	REVENUE/ PASS.	NET OPER. COST/ PASS.	NET OPER. COST/ VEH-HR.	NET OPER. COST/PASS. CONV. TO 1988 DOLLARS	NET OPER. COST/VEH-HR CONV. TO 1988 DOLLARS	YEAR OF DATA	TYPE OF SERVICE
MGR	Merril, WI	9,500	5.5	1,727	280	0.029	10.4	0.35	$1.37	$14.25	1.96	20.41	1980	Point Deviation
mbus/Maxi	Westport, CT	30,000	22.0	1,350	2,200	0.073	14.0	0.27	$1.70	$20.03	2.43	28.68	1980	Flexible Fixed Route/Demand Responsive
Teltran	Ann Arbor, MI	106,000	23.5	4,510	2,500	0.024	5.6	0.23	$3.54	$19.85	6.89	38.65	1977	Zonal Demand Responsive
Dial-A-Ride	La Habra, CA	65,000	16.2	4,012	287	0.004	3.8	0.60	$4.24	$15.87	6.07	22.73	1980	Dial-A-Ride
Dial-A-Ride	Villa Park, CA	92,500	19.6	4,625	407	0.004	4.2	0.56	$3.99	$16.75	5.71	23.99	1980	Dial-A-Ride
Dial-A-Ride	Fullerton, CA	94,000	22.0	4,270	385	0.004	3.5	0.56	$4.69	$16.30	6.72	23.34	1980	Dial-A-Ride
Trans-Cab	Peterborough Ont.	3,400	4.4	773	350	0.100	N/A	0.29	$0.90	N/A	1.63	N/A	1978	Zonal Demand Responsive
Badger Cab	Madison, WI	170,000	52.1	3,263	2,000	0.012	N/A	0.90	N/A	N/A	N/A	N/A	1980	Demand Responsive
Mission St. Jitney	San Francisco California	63,000	5.0	12,600	N/A	N/A	N/A	0.50	N/A	N/A	N/A	N/A	1980	Fixed Route
Dial a Ride	Palos Verdes,CA	N/A	N/A	N/A	N/A	N/A	3.36	N/A	N/A	$32.30	N/A	$32.30	1988	General public Dial a Ride
Dial a Ride	Pomona V., CA	N/A	N/A	N/A	N/A	N/A	4.37	N/A	N/A	$26.65	N/A	$26.65	1988	General public Dial a Ride
Dial a Ride	Redondo Beach California	N/A	N/A	N/A	N/A	N/A	3.70	N/A	N/A	$40.23	N/A	$40.23	1988	General public Dial a Ride
Dial a Bus	Rochester (Greece), NY	N/A	N/A	N/A	N/A	N/A	4.90	N/A	$3.44	$18.25	$7.54	$40.03	1975	General public Dial-a-Bus
Loop Bus	Rochester (Irondequat), NY	N/A	N/A	N/A	N/A	N/A	3.00	N/A	$7.00	N/A	$15.35	N/A	1975	Loop bus in a small community
Vanpool	Spokane, WA	N/A	N/A	N/A	N/A	N/A	8.70	N/A	$2.20	$19.00	$2.41	$20.84	1985	Vanpool operated by the transit authority
Vanpool	Winston, NC	N/A	N/A	N/A	N/A	N/A	9.30	N/A	$1.10	$10.40	$1.21	$11.41	1985	Vanpool operated by the transit authority
Vanpool	San Francisco California	N/A	N/A	N/A	N/A	N/A	7.90 *	$1.19	$1.19	N/A	$2.15	N/A	1978	Golden Gate Vanpool Demonstration Project
Dial a Ride	Chicago Schaumburg, IL	50,000	N/A	N/A	N/A	N/A	N/A	N/A	$5.42	$24.93	$7.04	$32.36	1981	Suburban Dial a Ride in a low density upper-middle income community.
Dial a Ride	San Diego, CA	N/A	N/A	N/A	N/A	N/A	5.90	$0.73	N/A	$15.97	N/A	$16.58	1987	General Public Dial a Ride primarily serving as feeder to fixed route bus service
Dial a Ride	Phoenix Arizona	N/A	N/A	N/A	N/A	N/A	2.31	$0.96	$6.05	$18.56	$6.05	$18.56	1988	General Public Dial a Ride primarily serving as feeder to fixed route bus service
Median - Dial-A-Bus	50 Systems	18,000	7.6	2,059	206	0.011	5.9	0.29	$1.82	$10.00	3.29	18.10	1978	
Median - Shared Ride Taxi	28 Systems	34,200	11.4	4,110	260	0.007	5.5	0.45	$1.70	$9.95	3.08	18.01	1978	

Sources: General Community Paratransit Services in Urban Areas; Multisystems, Inc., 1982. Operating Statistics for Existing Projects, Orange County Transportation Department (one page summary). The Rochester, New York Integrated Transit Demonstration, U.S. DOT., U.M.T.A., 1979. National Urban Mass Transportation Statistics: 1985 Section 15 Annual Report. Golden Gate Vanpool Demonstration Project, U.S. DOT, UMTA, 1979. San Diego DART System Statistics, 1984-1987. Contract with Arnett Cab Service for North Phoenix Dial a Ride, 1988. The Consumer Price Index, taken from the U.S. Department of Labor, Bureau of Labor Statistics was used to convert cost figures to 1988 Dollars.

* Since generally there was only one trip per hour, passengers per vehicle trip was assumed to be the same as passengers per vehicle hour.

FACTORS USED IN THE ESTIMATION OF NON-WORK TRIPS

DAILY NON WORK TRIPS BY TRAFFIC SERIAL ZONE

TRAFFIC SERIAL ZONE	DAILY NON WORK PERSON CORRIDOR TRIPS	DAILY MEDICAL PERSON CORRIDOR TRIPS	DAILY SHOPPING PERSON CORRIDOR TRIPS	DAILY PERSONAL & FAMILY BUSINESS CORRIDOR TRIPS
151	3828	172	1378	995
152	1077	48	388	280
153	764	34	275	199
154	648	29	233	169
161	1822	82	656	474
162	42	2	15	11
163	1893	85	681	492
164	1507	68	543	392
165	1240	56	446	322
166	99	4	36	26
168	1283	58	462	334
169	1414	64	509	368
171	1098	49	395	286
177	593	27	213	154
178	325	15	117	85
179	1450	65	522	377
180	2544	114	916	661
181	2044	92	736	531
182	523	24	188	136
183	1654	74	596	430
186	644	29	232	167
187	565	25	203	147
188	2370	107	853	616
189	496	22	178	129
190	1783	80	642	464
191	1152	52	415	300
192	3502	158	1261	911
194	38	2	14	10
195	0	0	0	0
196	502	23	181	131
197	1163	52	419	302
198	1164	52	419	303
199	3302	149	1189	859
200	1008	45	363	262
201	0	0	0	0
215	19	1	7	5
216	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
7	0	0	0	0
103	0	0	0	0
110	0	0	0	0
117	2177	98	784	566
118	0	0	0	0
567	4104	185	1478	1067
573	27	1	10	7
574	7	0	2	2

DISTRIBUTION OF NON-WORK TRIPS GENERATED WITHIN THE CORRIDOR TO SHOPPING COMPLEXES AND SERVICE AREAS WITHIN THE CORRIDOR

	DISTRIBUTED TO		
TYPE OF TRIP	CLOSEST COMPLEX OR OWN SERVICE AREA	NEXT COMPLEX OR NEXT SERVICE AREA	THIRD COMPLEX OR NEXT SERVICE AREA
Shopping	68.00%	22.00%	10.00%
Medical	40.00%	40.00%	20.00%
Family and Personal business	50.00%	37.50%	12.50%
All other Non-work trips	33.33%	33.33%	33.33%

Source: Based on average trip lengths by trip purpose as reported in the 1983 NPTS, Vol. II Table E-96.

CORRIDOR SECTION EQUIVALENTS

SECTION	TRAFFIC SERIAL ZONES		CENSUS TRACT (S)
Southwest	177	194	17.09
West of 183	186	195	
South of Spicewood Springs Road	188	196	
	189	198	
	190	214	
Northwest	151		204
West of 183	152		
North of Spicewood Springs Road	187		
South of Cedar Park	161		
	178		17.1
	179		
	180		
	181		
Southeast	183		17.08
East of 183	191		
South of McNeil Road	199		
	215		
Northeast	153	164	204
East of 183	154	166	
North of McNeil Road	162	168	
South of Cedar Park	163	169	
Cedar Park/Leander	1		203
	2		
	3		
	7		
	103		
	110		
	117		
	118		
	119		
	567		
	573		205
	574		

TRAFFIC ZONE SHOPPING COMPLEX EQUIVALENTS

SIMON DAVID	SAFEWAY	PIC' N' SAVE & TOM THUMB	SKAGGS	SAFEWAY & HEB
194	177	168	161	1
195	189	169	163	2
214	190	182	164	3
1/2 of 198	191	183	165	7
215	197	184	166	103
	199	188	178	110
	1/2 of 198	1/2 of 162	179	117
		1/2 of 181	180	118
		1/2 of 187	1/2 of 181	151
			1/2 of 187	152
			1/2 of 162	153
				154
				567
				573
				574

DEFAULT FACTORS USED TO COMPUTE NON-WORK TRIPS GENERATED PER HOUSEHOLD

ITE FACTORS

AM PEAK EXIT FACTORS	DU
SINGLE FAMILY(SF_DU_AM):	0.55
MULTI FAMILY(MF_DU_AM):	0.40
MOBILE HOMES:(MH_DU_AM)	0.38

AM PEAK EXIT FACTORS	ACRES
SINGLE FAMILY(SF_AC_AM):	1.60

DAILY VEHICLE TRIPS	DU
SINGLE FAMILY(SF_DU_DA):	10.00
MULTI FAMILY(MF_DU_DA):	6.60

DAILY VEHICLE TRIPS	ACRES
SINGLE FAMILY(SF_AC_DA):	26.20
MOBILE HOMES:(MH_AC_DA):	39.10

NPTS FACTORS

PERCENT AM PEAK VEHICLE WORKTRIPS (AM_VEH_WORK):	0.46
AVERAGE AM PEAK WORKTRIP VEHICLE OCCUPANCY (AM_WORK_OCCUP):	1.20
PERCENT DAILY VEHICLE NON WORK TRIPS (%_VEH_NONWORK)	0.72
AVERAGE DAILY NONWORK VEHICLE OCCUPANCY (NONWORK_OCCUP)	1.6
PERCENT DAILY SHOPPING TRIPS (%_SHOPPING)	0.36
PERCENT DAILY FAMILY & PERSONAL BUSINESS (%_PERS_BUSINESS)	0.26
PERCENT DAILY MEDICAL TRIPS (%_MEDICAL)	0.045

MARKETING STUDY FACTORS

WORK PERCENT INTRACORRIDOR (WORK_CORRIDOR):	0.11
PERCENT DISCRETIONARY TRIPS INTRA-CORRIDOR (%_DISC_CORRIDOR)	0.20

FACTORS USED IN THE ESTIMATION OF WORK TRIPS

AREAS WITH POTENTIAL FOR GENERATING WORK TRANSIT TRIPS

EMPLOYMENT CENTER	SECTOR(S) WITH POTENTIAL FOR GENERATING WORK TRANSIT TRIPS	CORRESPONDING TRAFFIC ZONES WITH POTENTIAL FOR GENERATING WORK TRANSIT TRIPS (Located over 10 miles from the employment center)
Texas Instruments	Cedar Park /Leander	1, 2, 3, 7, 103, 110, 567
3M	Cedar Park /Leander	1, 2, 3, 7, 103, 110, 567
Northwest Techniplex	Cedar Park /Leander	1, 2, 3, 7, 103, 110, 567
Arboretum Complex	Cedar Park /Leander	1, 2, 3, 7, 103, 110, 117,118, 119, 567, 573, 574
	Northwest	151, 152, 178
	Northeast	153, 154
The Avallon	Cedar Park /Leander	1, 2, 3, 7, 103, 110, 117, 118, 119, 567, 573, 574
The Stratum	Cedar Park /Leander	1, 2, 3, 7, 103, 110, 117, 118, 119, 567, 573, 574

POTENTIAL CARPOOLERS (THOSE LIVING 10+ MILES FROM WORK) BY EMPLOYMENT CONCENTRATION

EMPLOYMENT IN TEXAS INSTRUMENTS

TSZ OVER 10 MILES	1,988 EMP TI-1st SHIFT PEAK-TRIPS	PERCENT OF ALL EMP.
1	14	0.66%
2	46	2.18%
3	24	1.13%
7	61	2.87%
103	2	0.12%
110	24	1.14%
567	7	0.33%
Total	180	
Perc. of All Emp	8.44%	
Total Number of Employees =		2129

Note: Assumption: 1 employee = 1 person trip at peak.

EMPLOYMENT IN 3M

TSZ OVER 10 MILES	1,988 EMP PEAK-TRIPS	PERCENT OF ALL EMP.
1	2	0.66%
2	7	2.18%
3	3	1.13%
7	9	2.87%
103	0	0.12%
110	3	1.14%
567	1	0.33%
Total	25	
Total Number of Employees =	300	

Note: Assumption: 1 employee = 1 person trip at peak.
Note: Assumption: Percentages are the same as TI's

EMPLOYMENT IN THE AVALLON & THE STRATUM

TSZ OVER 10 MILES	1985 POP FOR TSZ	1,988 EMP PEAK-TRIPS	PERCENT OF ALL PER-TRIPS
1	977	3	0.75%
2	3,224	9	2.48%
3	1,667	4	1.28%
7	2,004	5	1.54%
103	173	0	0.13%
110	795	2	0.61%
117	1,585	4	1.22%
118	0	0	0.00%
567	494	1	0.38%
573	27	0	0.02%
574	8	0	0.01%
Total	10,954	29	

Avg. AM Person-Trips of Generator: 349
Calculated from ITE Report.
8.44% of Avg. AM Person-Trips of Generator: 29
(8.44% is the percentage of TI employees that commute over 10 miles within the corridor)

EMPLOYMENT IN N.W. TECHNIPLEX

TSZ OVER 10 MILES	1,988 EMP PEAK-TRIPS	PERCENT OF ALL PER-TRIPS
1	5	0.66%
2	17	2.18%
3	9	1.13%
7	22	2.87%
103	1	0.12%
110	9	1.14%
567	3	0.33%
Total	65	

Avg. AM Person-Trips of Generator: 773
Calculated from ITE Report.
Note: Assumption: Percentages are the same as TI's

EMPLOYMENT IN THE ARBORETUM

TSZ OVER 10 MILES	1985 POP FOR TSZ	1,988 EMP PEAK-TRIPS	PERCENT OF ALL PER-TRIPS
1	977	7	0.42%
2	3,224	24	1.37%
3	1,667	12	0.71%
7	2,004	15	0.85%
103	173	1	0.07%
110	795	6	0.34%
117	1,585	12	0.67%
118	0	0	0.00%
151	5,217	39	2.22%
152	1,470	11	0.63%
153	974	7	0.41%
154	827	6	0.35%
178	427	3	0.18%
567	494	4	0.21%
Total	19,834	147	

Avg. AM Person-Trips of Generator: 1,744
(calculated using ITE report.)
8.44% of Avg. AM Person-Trips of Generator 147
(8.44% is the percentage of TI employees that commute over 10 miles within the corridor)
Employees peak trips are allocated based on the population of each TSZ.

TRIP ATTRACTIONS - EMPLOYMENT

COMPLEX	AM PEAK OF GENERATOR ENTER (Trips/1000 S.F.)	AM PEAK OF GENERATOR ENTER (Trips/Employee.)	AM PEAK OF GENERATOR ENTER (Veh. Trips)	AM PEAK OF GENERATOR ENTER (Person Trips)	IN-CORRIDOR OF GENERATOR ENTER (Person Trips)
Arboretum 1	1.81		293	351	39
Arboretum 2	1.81		644	773	85
Arboretum Point	1.87		179	215	24
Great Hills	1.87		203	243	27
Health Care International		0.67	135	161	18
Total "Arboretum Office Complex"			1,453	1,744	192
3M		0.71	213	256	84
The Stratum	1.81		281	337	37
The Avallon		0.13	10	12	1
Texas Instruments		0.71	1,704	2,045	669
N.W. Techniplex	1.81		644	773	85

Auto Occupancy Factor: 1.2. Taken from the 1983 National Personal Transportation Study (NPTS) Peak Factor.
In-Corridor factor TI and 3M: 0.3272
In-Corridor factor: 0.11
Office building vacancy rate: 35.3%. Taken from Accross the Nation, 2nd Quarter 1987, Cushman & Wakefield.

CALIBRATION OF EMPLOYMENT FIGURES FOR THE TRIP ATTRACTIONS MODEL

COMPLEX	TYPE	ADDRESS	AREA (Sq. Feet)	ACTUAL AND *ESTIMATED* EMPLOYMENT	TRAFFIC SERIAL ZONE
Arboretum 1	Office Building	10000 Research	250,000	***608***	214
Arboretum 2	Office Building	10000 Research	550,000	***1,338***	214
Arboretum Point	Office Building	9505 Arboretum	148,000	***360***	214
Great Hills	Office Building	Great Hills & Loop 360	167,706	***408***	214
Health Care International	Office Building	9737 Great Hills Trail		200	214
Total "Arboretum Office Complex"	Office Building		1,115,706	***2,914***	214
3M	Light Industrial	705 Research Blvd.		300	199
The Stratum	Office Building	183 & Balcones Woods	240,000	***584***	198
The Avallon	Nursing Home	10415 Marado Cr.	126,000	74	198
Texas Instruments	Light Manufacturing	12501 Research		2400	183
N.W. Techniplex	Office Building	183 & Technology	550,000	***1,338***	183

EMPLOYMENT ESTIMATION FOR KEY ZONES IN THE CORRIDOR 183 CORRIDOR MODEL VERSUS CMTA 1985 FIGURES

TRAFFIC SERIAL ZONE	A 1988 ESTIMATED EMPLOYMENT (ONLY MAJOR GENERATORS)	B CMTA ESTIMATED 1985 EMPLOYMENT FOR THE TRAFFIC SERIAL ZONE	DIFF. BETWEEN B AND A
183	3,738	4,049	-7.68%
198	658	707	-6.93%
199	300	259	15.83%
214	2,914	943	209.01%*

* This difference can be explained by the fact that most of the development in the arboretum area has occurred in the last three years.

HOURLY COSTS AND SUBSIDIES REQUIRED FOR THE NON-WORK TRIP OPTIONS

HOURLY COSTS AND SUBSIDIES REQUIRED FOR THE NON-WORK TRIP OPTIONS

	OPTION	AVERAGE HOURLY ESTIMATED TRANSIT DEMAND		TOTAL HOURLY COST (Avg. cost/hr. X number of veh.)		TOTAL HOURLY SUBSIDY			
						$1.00 FARE		$1.50 FARE	
				HIGH PROD. 6.0 PASS./HR.	AVG. PROD. 3.0 PASS./HR.	HIGH PROD. 6.0 PASS./HR.	AVG. PROD. 3.0 PASS./HR.	HIGH PROD. 6.0 PASS./HR.	AVG. PROD. 3.0 PASS./HR.
HIGH RIDERSHIP (3%)	Service Area, private contractor	South	46	$213	$400	$168	$355	$145	$332
		North	46	213	400	168	355	145	332
		Leander/C.P.	28	133	240	105	212	92	198
	Service Area, transit authority	South	46	246	460	200	415	177	392
		North	46	246	460	200	415	177	392
		Leander/C.P.	28	153	276	126	248	112	234
	Service Area, shared	South	46	141	264	95	218	72	195
		North	46	141	264	95	218	72	195
		Leander/C.P.	28	88	158	60	130	46	116
AVG. RIDERSHIP (1%)	Service Area, private contractor	South	15	80	133	65	118	57	111
		North	15	80	133	65	118	57	111
		Leander/C.P.	9	53	80	44	71	39	66
	Service Area, transit authority	South	15	92	153	77	138	69	131
		North	15	92	153	77	138	69	131
		Leander/C.P.	9	61	92	52	83	47	78
	Service Area, shared	South	15	53	88	37	73	30	65
		North	15	53	88	38	73	30	65
		Leander/C.P.	9	35	53	26	43	21	39

SUMMARY OF AVAILABLE INFORMATION - AUSTIN

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DOCUMENT	INFORMATION PROVIDED
Demographics for 183 Corridor Author: CMTA (developed for TCAP)	- 1985 Total Population by TSZ for every zone in the corridor - 1985 Occupied Units - 1985 Household Size of Occupied Units - 1985 Retail Employment - 1985 Non-Retail Employment - 1985 Total Employment - 1980 Median Household Income - 1980 Mean Household Income - PGM Sector of every TSZ - Zip Code - Area in Acres - Population/Sq. Mile - Employment/ Sq. Mile - 1986 ACC Students - 1986 U.T. Students - 1986 St. Edwards Students - ATS Planning Sector

DOCUMENT	INFORMATION PROVIDED
Marketing Baseline Study (February 1988) Author: Nustats (for Capital Metro)	- Map of Corridors - Origin and Destination for work trips (Sample = 7692) - Origin and Destination for school trips (Sample = 7692) - Origin and Destination for discretionary trips (Sample = 7692) - Home corridor, public transit usage, level of dependancy on public transit

DOCUMENT	INFORMATION PROVIDED
Comparison of Ridership Levels 1987-1988 Author: CMTA (Spring B/A Counts)	- 1987 Riders for every existing route - 1988 Riders for every existing route - Percent change - 1987 Hours for every existing route - 1988 Hours for every existing route - Percent change - 1987 Riders/Hour for every existing route - 1988 Riders/Hour for every existing route - Percent change

DOCUMENT	INFORMATION PROVIDED
Capital Metro On Board Survey (April 1986) Author: Nustats (for CMTA)	- Trip purpose from by trip purpose to - Fares - Mode of Access to Bus - Mode of egress - Number of buses riden - Age Distribution of Capital Metro passengers - Gender of CMTA passengers - Ethnic composition of transit ridership - Household size of CMTA transit riders - Auto ownership of CMTA transit riders - Household income of CMTA passengers

DOCUMENT	INFORMATION PROVIDED
Northwest Area Land Use Guidance Plan	- Map of the area and sub-areas
(Revised January 1986)	- Adopted roadway plan map
	- Residential component of the land use guidance plan of the sub-areas
Author: PGM	- Existing housing units of each sub-area
	- Platted housing units of each sub-area
	- New housing units of each sub-area
	- Total housing units of each sub-area
	- Existing Population of each sub-area
	- Platted population of each sub-area
	- New population of each sub-area
	- Total population of each sub-area
	- Non-Residential component of the land use guidance plan of the sub-areas
	- Existing acres of retail
	- New acres of retail of each sub-area
	- New acres of retail of each sub-area along 183
	- Total acres of retail of each sub-area
	- Retail employment of each sub-area
	- Existing acres of office R&D
	- New acres of office R&D of each sub-area
	- Total acres of office R&D of each sub-area
	- Office R&D employment of each sub-area
	- Total non residential employment of each sub-area
	- Total non residential acres of each sub-area
	- Existing strip centers (leasable area)
	- Total strip centers (leasable area)
	- Existing neighborhood centers (leasable area)
	- Under construction neighborhood centers (leasable area)
	- Total neighborhood centers (leasable area)
	- Existing community centers (leasable area)
	- Under construction community centers (leasable area)
	- Total community centers (leasable area)

DOCUMENT	INFORMATION PROVIDED
Basic data 1987 Author: PGM	- Land use distribution at planning sector level - Urban land use patterns map for whole city - Map of major retail centers - List of major employers - Map of major employers - List of major manufacturers - Map of major manufacturers - List of major office buildings - Map of major office buildings - List of major hotels and motels - Map of major hotels and motels - List of major banks - Map of major banks - List of major shopping centers - Map of major shopping centers - List of secondary schools, colleges and universities - Map of secondary schools, colleges and universities - List of public libraries - Map of public libraries - List of Metropolitan and District parks - Map of Metropolitan and district parks - List of hospitals and EMS stations - Map of hospitals and EMS stations - Daily traffic volumes on selected locations (80-85) - Annual transit ridership

*U.S. GOVERNMENT PRINTING OFFICE: 1991-282-65755519

NOTICE

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